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Minerals Deposited by Bacteria in Mine Water

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By John Parry

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Rotation Mechanisms of Rock Drills

The effectiveness of a power-driven rock drill depends upon positive rotation of the steel. The development of mechanisms that have proved successful for drills, both hammer and piston types, is described.

By Royal J. Day

A WEEKLY JOURNAL REPRESENTING THE WORLD'S MINING AND METAL INDUSTRIES

June 9, 1923

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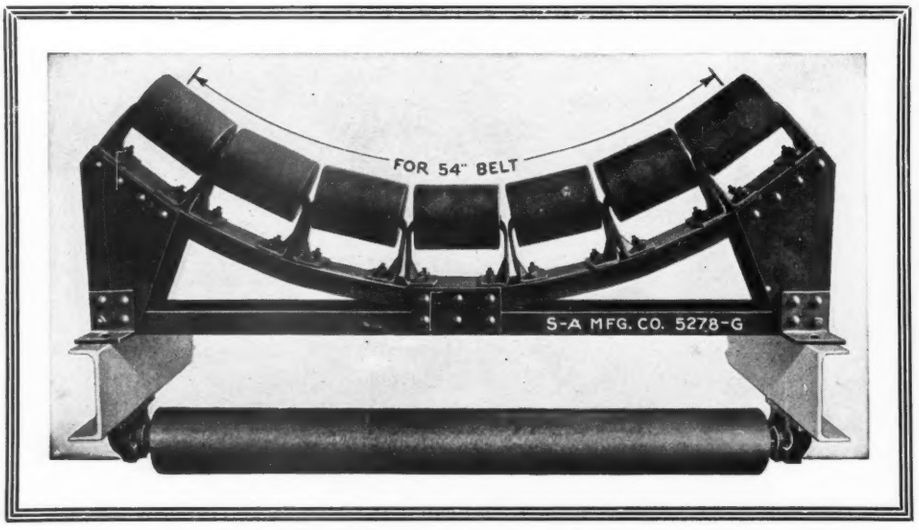

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ENGINEERING & MINING
JOURNAL-PRESS
JOSIAH EDWARD SPURR, Editor

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The Backwoods Taxation Bandits

THE IDEA is popularly gaining ground in many states that metals and minerals, especially those which occur in large tonnages and regular beds, are essentially the property of the commonwealth; that the titles and patents to these ores which have been issued under various state and especially federal laws were the result of a mistaken policy, and that legislation, especially state legislation, has the duty to rectify this oversight. The recurrent proposal to put the coal mines under direct national control is one symptom of this feeling; it is a socialistic remedy, and its execution would of course be followed by the nationalization of the iron mines, and so on and so on.

Another popular remedy of the supposed error in the past is special taxation, a method which is being used in many directions by the Common People to level inequalities in the distribution of wealth. This remedy has appealed especially to certain states, whose essentially granger population feel that outside capital is looting subsoil mineral wealth, without adequate tribute to the sovereign commonwealth, and removing an inheritance which can never be replaced. It is the same underlying idea that Mexico has, that mineral wealth belongs to the state; and, indeed, it is a common theory in many countries.

An example of taxation resulting from this theory is the Minnesota tax of 6 per cent on the value of iron ore mined. From this tax thirty-seven companies in Minnesota, producing two-thirds of the iron ore mined in the United States, appealed to the Supreme Court, representing that the tax was a discriminatory property tax, and therefore unlawful. The Supreme Court on May 7 upheld the State of Minnesota, deciding that the tax was clearly an occupational tax. Fundamentally, with all deference to the legalistic lights, it is neither; it falls into the old class of crown tributes on metal mined; it is a royalty paid to the commonwealth, on the theory, which is contrary to the law, that the commonwealth owns the ore. Technically, these taxes are being called severance taxes—taxes on severing the ore from its bed or vein, and transmuting it into an article of industrial commerce. Such a severance tax has been imposed on the bauxite deposits of Arkansas, mined chiefly by a subsidiary of the Aluminum Company of America. Except for a technical oversight on the part of the legislators this tax would have been 25c. per ton instead of about 5c.

What are the good and bad points of this belief and plan? Mining industries, like other industries, are run, on the average, on a close competitive basis: those of one state compete with other states, and with foreign countries. An increase in taxation in one state will inevitably close down certain mines in that state which have been running near the border line of profits, and open up certain mines in other states or abroad. Such closed-down mines, the grangers of Minnesota and Arkansas should remember, will not benefit them; their fellow citizens will be thrown out of employment; the amount of money flowing into the state and being distributed will be curtailed. They have chased out the goose which laid the golden egg into some other state, or to seek refuge in a foreign clime. From the federal viewpoint, a decrease in the production of iron from Minnesota and an increase in that from Cuba—a decrease in the production of bauxite from Arkansas and an increase in that from British Guiana—has a corresponding unfavorable significance; it means a lessening of the industry, wealth, and prosperity of the country.

From the theoretical standpoint, considering the socialistic belief, it is ridiculous to assume that the iron ores of Minnesota are essentially the property of the good Scandinavian farmers who were presented by the people of the United States with farms on the prairies in the southern part of the state; or that the Arkansas granger has any title to the bauxite deposits of the state. They are national assets: they should benefit equally every American citizen, and not be the subject for piratic taxation by the state or town in which they lie.

The Minnesota iron companies have suffered from this predatory taxation by the town of Hibbing; now the State of Minnesota holds them up again. The best interests of the American citizen lie in encouraging American industry, not in closing it down. An individual state has no real right under the federal law to tax the consumers of the whole United States for their iron and aluminum, and thus make the householder of New York and San Francisco pay tribute to the farmers of Minnesota and Arkansas.

Exchanging Ideas

A NEED of the petroleum industry today is the freer exchange of ideas. Its operations are as scattered as those of the rest of the mining industry of which it is a part, and it frequently happens that engineers and operators in one locality do not become aware of changes and improvements in practice in distant fields until considerable time has elapsed. Of course, with the keen competition that there is today in the search for petroleum it is not to be expected that information of a geological nature that may be of value in bringing in new production will be divulged. Such information is only obtained at great expense, requiring the maintenance of highly organized geological staffs as well as a lavish outlay for prospecting, and will be guarded until it becomes profitable to release it or until it is no longer of value. But there are many things, such as improved methods of drilling, improvements in equipment, the local invention of specialties, and the devising of practical kinks, that are often worth wider publicity than they may gain and that, moreover, may be worth money to those who know of them.

Occasionally one hears it said that a certain superintendent is a good "trouble" man, because of the ingenuity he displays in recovering a string of tools or in saving a hole where another would have lost it. The story in such cases is worth putting into black and white to be passed on to others in distant fields. Much information, and of a very practical and useful sort, could be compiled and published regarding the yield per acre of different fields. This would dispel notions of fabulous yields that might otherwise be entertained.

The medium for such exchange of ideas already exists in the technical press and in the journals and meetings of local and national societies. These should be utilized to the greatest possible extent. Many engineers do not realize what opportunities they might make use of but ignore instead. Then, again, some are eager to obtain information but loath to impart it. This is a failing of companies rather than of individuals, and is not their most lovable trait. Exchanging ideas is a fifty-fifty proposition, a matter of give and take, the giving usually coming first. It is thus that mining and ore-reduction practice have advanced to their present state of high efficiency. The technology of petroleum production is comparatively simple, but who is there who will say that oil-field practice cannot be improved?

Centrifugal Force in Ore Dressing and Metallurgy

ANNOUNCEMENT was made the other day that the U. S. Bureau of Mines is contemplating an intensive research in connection with the use of centrifugal force in various metallurgical processes. No definite work has yet been planned, but it is desired to get as much data as possible from those who have experimented with any apparatus making use of centrifugal force, and then, if it seems advisable, the Bureau will tackle the particular applications which seem to be most promising.

At first thought, it seems peculiar that centrifugal force has not been brought into play in metallurgical equipment more than it has. About the only machines that we can think of in which this principle is now used commercially are those in which suspended particles are separated from gases, which take the form of conical closed tanks in which the gases are swirled; grinding machines in which the grinding rollers are suspended and, when revolved, press against an outer confining ring, as in the Huntington and Griffin mills; and small centrifugal amalgamators for precious-metal ores. This is not to say that other machines for concentrating and classifying ore have not been designed and tried. There were, for example, the Clarkson-Stansfield and Pape-Henneberg separators, which worked on the principle of feeding dry ore to a rapidly revolving circular disk. The ore, of course, was immediately thrown off and caught in several concentric troughs, the idea being that the light particles of gangue would fall in the nearer troughs and that the heavy mineral would carry farther and would be found in the receptacles placed at greater distance from the revolving disk. Separators designed for handling a water pulp have also been devised, such as the Peck centrifugal separator, tried and condemned at Anaconda and Cananea ten or fifteen years ago; the Laist centrifugal separator for removing granular material from water and slime, also tried at Anaconda; the Mauss, Trent, and Gee separators, which were also tried some years ago, but so far as we know never were commercially successful. The basic idea in all of these is the same as that of the ordinary laboratory centrifuge. Their best field for success would seem to be in thickening pulp, but many improvements will have to be made before they can compete with apparatus of the Dorr type or filters of the Oliver, Portland, or American types. As concentrators, they have failed because large particles of gangue are mixed with the fine particles of mineral; in other words, there is too much middling. The advisability of a closely sized feed is obvious, and as screening has progressed considerably in the last few years, possibly centrifugal machines have chances that they did not have fifteen years ago. Mechanical troubles in driving the separators at the necessary high rotative speeds also appeared; and no good way to remove the mineral or thickened pulp continuously seems to have been developed.

Another machine which was never even tried was the child of the late David H. Browne's brain. It was his idea to clean molten slag by centrifugal action, and the plans for such a machine were all made, but never reached the machine shop, it being the opinion of those who pondered over them that this "slag whizzer" would have more than its share of mechanical troubles.

We hope that those who have designed or experimented with machines of this type will take advantage of the Bureau's offer and give as much helpful advice as possible. Though the idea was pretty well exploded several years ago so far as the concentration and thickening of ore pulps goes, it is possible that modern improvements in accessory apparatus may make further investigation advisable.

It would be agreeable to know that centrifugal force could be put to some great good other than taking the cream out of our milk.

As Others See Us

THE GREAT POPULAR VEHICLE for instruction today is fiction—the short story or the novel. Through that medium the average person gets much of his ideas of the world, of scenery, of social conditions—what the other nine-tenths do and think. Are the fiction writers reliable instructors for our vacant minds? We are apt to assume that, swallowing whatever is handed to us, until we are handed something with which we ourselves are familiar; then we usually awake to the fact that it is garbled and distorted. Alaska and the Yukon are familiar to all novel readers and movie-goers through Jack London and Rex Beach and the rest; but their productions are quite as strange and new to those who were familiar with the Yukon as to those who never left home.

We may cite an example or two showing how the mining industry looks to the novelist. The first is from the greatest popular educator, for good or bad, of all—the esteemed and renowned *Saturday Evening Post*. The hero in England starts off for Canada and the gold fields via steerage, determined to make his fortune in a year or bust. Does he bust? Not he. He has too much Character. He was too Strong. He reports thus to the lady who had sent him away to get Big and Fine:

> "I've been to the Yukon, and luck was with me, as it is with some men sometimes. I saw men die of greed and failure, and they murdered each other for greed, and robbed and fought and schemed and sweated and worked themselves to skeletons; and I—the second week I was there I struck it.

"I worked like hell when I thought I knew what I'd found. I didn't hope; it might have been a false lode. It just wasn't. I struck veins such as no man has struck here for twenty years, they say. I worked like hell! All for you, my darling, darling. Every step I went, every inch I dug, every time I heaved that blasted pickaxe in, I saw you, Anna! Fellows came out from the City; I could have sold my claim for a hundred thousand dollars before it was properly tested at all. I didn't. Company promoters and engineers came out by the dozen. You should have seen 'em! But I was counting everything for you, Anna; and—I was cool as death. I waited. I got the real men. It—it's working fine! The company's floated; I take over the London office. . . . It's all here; all right; working like a machine; the public's coming in."

So all you men—not mining engineers, but just ordinary men anywhere—that want to grow Big and Fine—away to the Yukon, and dig in your pickaxe, but beware of False Lodes.

The other example is from the highly rated popular novelist, W. L. George, and out of a book dedicated to H. G. Wells—a book held to be one of the great novels of some recent year. The real hero, quite properly, is a mining engineer. Here the mining engineer may see himself as (some) others see us:

"I'm a consulting engineer, you see. That means I've got to go to every desolate mountain and to every plague-stricken swamp, a thousand miles from any railway, if there's any metal there. It's a rotten life."

"You don't mean it," said Grace, demurely. . . . . "You love the work."

". . . Nobody'll ever make you see what it's like. Prospecting itself, hunting the golden slipper—halfbreeds who tell you lies, and natives waiting for you to fall asleep to murder you and steal your rifle, and white men, the queer sort of white man that lives in a Brazilian port or some way east of Suez where there ain't no Ten Commandments. The white man out there, that's the man. . . . He runs the black women and the yellow ones and the brown ones, and he's the fellow who sells rotten beef to the ships and now and then you meet him on the trail looking for the colour in the rock, or putting it there to diddle the London engineer. . . . When I come back I've forgotten how to shave, I can't make out what the papers are about, and I don't feel I want a bath any more. Why! Three months in the bush and the smell of the place gets right into you. You stop being white. You've got too near the earth. . . . It's when you stop being white that life sort of begins. . . . South America, with the pampas like a big green carpet that's trying to unroll—grass eight feet high, like green spears, thick and sharp at the point like a needle—and now and then when you're riding, perhaps just next to the track, a funny sort of 'S' that goes moving in the grass keeping you company: just a boa-constrictor in the grass."

"Horrible!" cried Grace.

We should like to quote the hero's remarks in extenso—they are so educational; but we skip.

"The jungle," he muttered—"black water all thick and sticky with something, the blood of trees, you might call it, and insects, and things. Sort of life asleep and trying to wake up. Everything dark and everything thick, and smelling of fungus and beasts. Other places, too, where you find a city if you dig under a temple, and, they say, still another city under that one—worlds on worlds."

His hands were close-gripped together, and there was sweat on his forehead. He spoke again, quite irrelevently.

"I'd a dog once, something between a collie and a sheep-dog he was, an ugly brute with eyes like sherry—he wouldn't eat when I had fever, he loved me all right. Used him as a pillow now and then. Some 'gators got him at Chinde." There was something wild and longing in his eyes now and a sorrow in his mouth.

Thus the mining engineer and the miner in fiction. It is a little curious that so little of popular writing has correctly pictured such a picturesque industry as mining. The sea, on the other hand, has had many veracious story writers and illuminating poets. There is a field for some real miner who knows how to write, or who can find out how.

Gold in Labrador

CAN A PESSIMIST write a prospectus? Is he not temperamentally unfit? Has anyone ever seen a prospectus written in other than an optimistic vein? Of course not. A prospectus may be defined as an optimistic statement regarding a proposition of possible or doubtful value, stock in which is being offered the public. Such thoughts were aroused some time ago by reading the prospectus of Labrador Goldfields, Limited. Surely its writer was an optimist. "Labrador is only a pleasant boat trip from Montreal," he said. "With a little co-operation on the part of the public, no hardship need be endured. Any red-blooded adventurous young man could hardly do otherwise than consider a trip to Labrador a wonderful summer holiday." All optimists would concur. Even Hades would have its red-blooded explorer, if not the ubiquitous tourist, were it humanly possible.

But why Labrador? The answer was "gold." Placer gold had been found there by H. C. Bellew, president of the company mentioned, according to Mr. Bellew himself. What conservative, intelligent, skillful, and competent men all earnestly believed would develop into the largest gold fields in the world were up in Labrador, stated the prospectus. Inquiry made of the Department of Agriculture and Mines at St. Johns, Newfoundland, within whose jurisdiction Labrador lies, elicited the reply that the department had not examined the region and could give no official information on the subject, knowing only what those who had staked claims in the regions had said. Previous inquiry made of the department at Ottawa had brought forth a suggestion that we write to St. Johns.

A bonanza in Labrador? Why not? First reports from the Klondike met with skepticism. It was no time to laugh, we felt, conscious all the while of our open-mindedness. But the Dominion Geological Survey at Ottawa has spilled the beans. It could well have done so earlier. In an official statement it sets forth facts regarding Labrador that make it appear extremely improbable that any discovery of importance has been made there, and that, in effect, expose Mr. Bellew and his associates as belonging to the cult of get-rich-quick promoters.

Labrador Goldfields made its offering as a "huge speculation—a gigantic gamble." No stock was for sale. The company claimed to control 104,000 leases in the Stag Harbor district, and to be in need of not money but men. To men of brawn and muscle, therefore, it offered leases at $200 each and a partnership under the terms of which the leaser gave the company 10 per cent on the first $100,000 taken from the mine, this royalty increasing with each successive $100,000 until it was 50 per cent on the fifth $100,000 extracted. The $200 to be paid was merely evidence of good faith on the leaser's part and was to be spent by the company in providing a great camp with the comforts and necessities of life and many of the luxuries. There would be no dividends for those who bought leases. Indeed, the company was playing a perfectly safe game for itself from every viewpoint.

DISCUSSION

"Engineering and Mining Journal-Press" is not responsible for statements or opinions published under "Discussion." In many cases the views expressed are diametrically opposed to editorial policy and belief.

Manganese Deposits of Lunenburg County, Nova Scotia

THE EDITOR:

Sir—In glancing over the letter of W. F. Jennison in the April 28 issue of the *Journal-Press*, I note that the author, in referring to the manganese deposits occurring in the granite fissure-veins of northern Lunenburg County, Nova Scotia, makes certain statements which he has enumerated in the following order, being briefly (the italics are mine):

1. That the iron minerals of the vein-filling are precipitated at the *top* of the vein. Mr. Jennison says this is due to the difference in *specific gravity* between the manganese minerals and the iron oxides.

2. Mr. Jennison next states that he believes the fissure filling is due to surface waters which have acted on very old—probably pre-Cambrian—sediments. These surface waters, after carrying some of the material into the fissures, caused a secondary action, resulting in purification and concentration within the fissures. Mr. Jennison follows this up by declaring that the present observed drainage system of the granite could not have had any but a problematical influence on the direction of movement of manganese-bearing waters, for the reason that, *since the period of deposition*, the *strata* have been tilted, folded and faulted . . . and that "Mr. Fearing has not given this full consideration."

3. Mr. Jennison closes his letter with the remark "I am inclined to concur in the theory of *post-glacial deposition.*"

In looking into these considerations it does not seem necessary to do more than to call attention to the fact that in my original article on these deposits, and in all subsequent discussion, it has been stated positively that iron is not characteristic of the outcrop alone but of the sides and bottoms of the orebodies as well. We are not concerned with specific gravity but with the question of solubility. In the Lunenburg deposits we have all the criteria necessary to prove that the ores were precipitated from descending solutions and that the manganese of these ores did *not* come from the granite, but was introduced into it long after it had crystallized. The depth to which such deposits can extend will depend upon the depth to which oxidation can extend. This is just another way of saying that below a certain point, which is known as the one of reduction, there can be no ore of this type because it will all have been precipitated out of solution and there will be no more left in solution to find its way to lower levels in the fissures because "that's all there is—there isn't any more"; and there won't be, until erosion has brought the deeper-seated regions closer to the surface.

We know where the Lunenburg ores end at depth. We know that alteration of the country rock also ends at approximately the same elevation. Mr. Jennison suggests that there may be ore lower down. If anybody wishes to explore these fissures at depth below the present orebodies I am willing to let him "go to it" and to bestow my best wishes and my blessings in return for being excused from joining in financing the undertaking.

In taking up paragraph No. 2 set forth above, I wish to point out that it is necessary to know something of the geological history of Nova Scotia before one may feel at liberty to make deductions of a scientific nature. I think Mr. Jennison would find it interesting to look further into this subject, and for a clear-cut, brief, description I hope he will pardon me for referring him to "The Gold Fields of Nova Scotia," which is Memoir E 20, Canada Department of Mines, Geological Survey Branch. The author is W. Malcolm, and the work is based largely on notes of Dr. E. R. Faribault.

The history of the Peninsula shows that a tremendous thickness of very old sediments—30,000 ft. approximately—locally termed "whin," and thought to be of Cambrian or pre-Cambrian age, underwent comparatively little erosion until after the great orogenic movement took place in Devonian time, when the granite batholith came to rest.

The accepted geologic history of the Peninsula further shows that the granite caused tremendous buckling and tilting of these invaded sediments, and regional uplifts and tremendous resulting erosion. So great was this erosion that before the end of the Devonian the underlying granite had been exposed and itself subjected to weathering. This history applies to the northern corner of Lunenburg County. The texture of the granite here is uniformly coarse over large areas and must have been deeply buried when it came to rest. Nevertheless, the Horton series, which is either very late Devonian or very early Carboniferous, is in part composed of an arkose derived from the granite.

The accepted geologic history of the Peninsula further shows that since the Devonian the land had risen and subsided regionally several times, without, however producing any important folding and faulting in central Nova Scotia. Certainly there is nothing to indicate the sort of thing that Mr. Jennison refers to as having again taken place since Devonian time.

The accepted geologic history of the Peninsula shows that it was subjected to glaciation during Quaternary time. The absence at that time of overlying sediments in the region of the manganese mines is to be inferred from the fact that the surface of the granite is everywhere scratched and polished by glacial action and that the drift consists entirely of granite of the same nature as the existing country rock. Several miles to the northwest of the deposits I managed to find one small piece of shale. The last movement of the ice in this vicinity was S. 17 E., and it is interesting to note that following this direction from the outcrop of the Upper Mine, one can find "nigger heads" of manganese ore mixed in with

glacial boulders on the higher, better-drained slopes. All this was brought out in my original article of Jan. 6 and in subsequent discussions. If Mr. Jennison believes in post-glacial deposition he must first explain how the glaciers came along and strewed pre-existing manganese ore over the landscape.

I would now like to take up the question of the source of the manganese:

1. It could hardly have been deposited in the granite fissures during the *latter portion* of the Devonian and the granite had not come in *before* that. The pre-granite rocks did not exist in this region *after that*, having been eroded away. It therefore seems dangerous to me to attribute the manganese of the granite fissures, or any other ore of such a "surface" type, to these older rocks which were swept off so rapidly. Is it not likely that these deposits would themselves be eroded away as fast as they were formed in the overlying sediments, so that, by the time weathering began in the granite, there would be little opportunity left for manganese to be deposited therein from the vanishing sediments above?

The lower Carboniferous rocks frequently contain deposits of manganiferous calcite, and, indeed, near Londonderry is a large deposit of ankerite that has been worked in the past as an iron mine. I know of no such deposit native to the pre-granite sediments, though these do contain small pockets of manganese ore here and there. The weathering of the Carboniferous rocks might easily supply the manganese of the fissures, as well as the iron thereof, and also a considerable portion of its large content of calcite. Conditions of *drainage and erosion* following the emergence of the Carboniferous series would favor the formation of such deposits as those in northern Lunenburg, and for these reasons I concluded that rocks of this age were the most likely source of the ore. It cannot be definitely *proved* from any data that I know of. The reasoning, however, is in line with actually observed *facts* and with the generally accepted, broad, geologic history of the region.

Philadelphia. FREDERICK C. FEARING.

How the Klondike Was Discovered

THE EDITOR:

Sir—Re Mr. A. E. Wills' account of the Klondike discovery published on page 305 of your issue of Feb. 17:

Mr. Wills' account is correct excepting that I outfitted at 60-Mile (now Ogilvie, Y. T.), 48 miles above Dawson. When my supplies ran short I recrossed the divide between Hunker Creek and Indian River, thence down Indian River to the Yukon River, thence up the Yukon to 60-Mile Post, which was maintained by Harper & Ladue. After replenishing my grub supply I came down the Yukon again, but found Indian River too low to permit poling, so continued on down to the mouth of the Klondike River and poled up the Klondike to the mouth of Hunker Creek. From there, I packed my grub on my back to the point where I had made the discovery, about three miles up Gold Bottom Creek, a tributary of Hunker Creek.

George Carmack and the Indians were camped at the mouth of the Klondike, and I gave him the information, asked him to come up, and told him the easiest route to take to reach my discovery. They came, and it was on their way *back* to the mouth of the Klondike that they made their discovery on Rabbit Creek (now called Bonanza Creek). Carmack and his two Indians staked next to me on Gold Bottom Creek, but I believe they did not record the Gold Bottom staking. The winter of 1895-96 I took out $620 in coarse gold on the Radford Discovery, Quartz Creek.

My discovery on Gold Bottom was made in July, 1896. I had no calendar, but as nearly as I could determine the date it was the fifteenth of July.

Dawson, Y. T. ROBERT HENDERSON.

The Difference Between Mine and Quarry

THE EDITOR:

Sir—Although the distinction between "mine" and "quarry" proposed by a member of the staff of the *Engineering and Mining Journal-Press* in the issue of May 5 is etymologically sound in its reversion to the Latin derivation of the word quarry from *quadrare*, to square, it seems not very satisfactory as a working definition, because it leads to the classification of the production of limestone for flux, in fact of stone in any other form than building blocks, as mining, whereas the production of crushed stone is generally called quarrying, some of the best-known quarries in the country being those producing crushed stone, and the operations for getting out stone in this form are of the same character as those employed for getting out building blocks.

The definition of these two terms given in the Century Dictionary is perhaps a little more complete and accurate than that quoted in the *Journal-Press* from Webster.

"The word 'mine' is generally applied to the excavations from which metals, metalliferous ores, and coal are taken; from 'quarries' are taken all the various materials used for building, as marble, freestone, slate, lime, cement, rock, etc. A 'quarry' is usually open to the day; a 'mine' is generally covered, communicating with the surface by one or more shafts."

The exceptions which could be found to this definition, as to the others proposed, and which are indeed provided for in it by the use of the qualifying adverbs "generally" and "usually," suggest that no categorical definition of mine or quarry is possible and that for classifying existing operations for a Directory of Mines and Quarries a series of definitions would be needed, each stating some clearly established characteristic of an operation that would definitely place it as mine or quarry. By the application of these specific test definitions the greater number of operations, even of the border-line variety, could be readily classified. Those not so easily disposed of would then have to be placed by careful consideration in each individual case of the nature of the operation, of the material produced, and of the customary usage.

As a start for such a series of test definitions (others may be needed, of course) I suggest the following:

Any underground operation is a mine.

Any operation for getting out coal, whether underground or open, is a mine.

Any operation getting out the materials by the force of water is a mine.

Any open operation getting out rock or other material which is itself the material desired, except coal, is a quarry.

Any operation, open or underground, getting out material which is not desired for itself, but is produced in order that a metal or metals may be extracted from it, is a mine. HELEN E. DAVIS.

Wilmington, Del.

Mining Investments

By T. A. Rickard

THE Investment Bankers Association of America is engaged in a study of mining securities as investments, and I have been asked to express an opinion as to what types of mining properties lend themselves best to financing by means of mortgage bonds. The particular type of security in question is a bond issue by a metal-mining company, which bond is a secured obligation, as contrasted with debentures.

Of the more prominent issues of mining bonds, notes, and debentures, embracing some twenty-two issues, eighteen are the obligations of companies producing copper. This is not surprising, because modern copper-mining operations have assumed dimensions that necessitate the employment of working capital in large amounts and the further use of money to meet the exigencies of a prolonged process of refining and marketing. The activities of these companies involve the operation of smelters that may, or may not, treat the ores of other mining companies. It has been possible for me to secure only a few of the indentures under which these mining securities have been issued, and of these only three relate to the issuance of first mortgage bonds. The security for the first-mortgage 7 per cent ten-year gold bonds of the Alaska Juneau Gold Mining Co. includes all mining claims, real estate, water rights, and personal property now owned or hereafter acquired. It is specifically provided that the company shall deduct no dividends out of surplus profits or distribute any of its assets or properties among its stockholders until the principal and interest on all the bonds shall be fully paid and discharged. Provision is made for an annual sinking-fund payment, beginning five years from the date of the bonds, which payment shall be a sum of money equal to at least 22 per cent of the face value of the bonds then outstanding, said sum of money being either in cash, or in whole or in part by deposit with the trustee of bonds secured by the indenture, such bonds to be placed to the credit of the sinking-fund payments at a price equivalent to the face value of the bonds, together with accrued interest and a premium of 10 per cent. The first-mortgage 6 per cent fifteen-year gold bonds of the Granby Consolidated Mining, Smelting & Power Co. are secured by smelter lands, submerged lands, lime lands, town lands, mineral lands (excepting coal and petroleum), mineral claims, and personal property acquired subsequently by the company with proceeds of any bond issued under the indenture, personal property, and water rights. Provision is made in the indenture for the retirement annually of 4 per cent of the aggregate face amount of bonds authenticated prior to the prescribed sinking-fund payment-date. The ten-year convertible sinking-fund 8 per cent gold bonds of the Cerro de Pasco Copper Corporation are not secured by any physical property. The company is obligated to make a sinking-fund payment every six months of a sum, in cash, equal to 20 per cent of the net earnings for the six months next preceding the date of such payment. The net earnings are considered before deducting interest charges and depletion.

The 7 per cent fifteen-year convertible bonds of the Consolidated Coppermines Co. are secured by mining claims, real estate, water rights, and personal property; also by stocks and bonds of subsidiary companies. It is provided that no property hereafter acquired other than that acquired by use of the proceeds of these bonds shall be subject to the lien of the first mortgage. The provision for a sinking fund stipulates that each year, commencing three and one-half years from date, the company shall pay to the trustees 25c. on each ton of ore treated during the preceding calendar year. Other notable issues are the Anaconda-Chile bonds and debentures. The latter carry the usual conversion privilege, by which the debentures can be exchanged at any time during the first ten years for Anaconda stock at specified prices. Several such issues of convertible bonds have proved extremely profitable; for example, those of the Nevada Consolidated, Utah Copper, and Boston Consolidated companies. An authority, Mr. Paul Clay, in a handbook published by Moody, says: "Copper mining bonds without the convertible privilege are apt to be rather inferior investments unless the issues are very small in total amount." He dwells upon the "uncertainties," and states that "because of these uncertainties a copper property cannot conservatively be mortgaged for more than a third to a half of its total value." If a real-estate loan be sound on a 2:1 valuation, then a mining loan should call for a ratio of at least 3:1. Undoubtedly it bespeaks the sound industrial character of mining operations that they should become the subject of real investment; that is, the use of money on the expectation that the principal is so safe that the current rate of interest is an adequate return. Having regard to the vicissitudes of mining, it is desirable that the mortgage be limited to, say, five years. The value of bonds is based usually on past performance, whereas that of mining bonds is based mainly on ore reserves. The investor should be protected against the wastage of such resources during the life of the mortgage, and this can be done by an agreement to set aside a specified sum per ton of output, for the purpose of amortizing the principal.

Mining enterprise is essentially speculative, because it exploits a wasting asset; it is based on ore deposits that are subject to variation in contents, size, and continuity; it deals with metallic products of variable market value. These factors introduce an element of risk, which entails speculation. To make money in mining it is advisable to recognize the risk involved and to insist upon a return sufficient to compensate for that risk. The use of money on an investment basis presupposes that the principal is absolutely safe; therefore the expected return is a rate of interest regulated by the condition of the money market. Such use of money excludes the fortunate chances of mining, but does not wholly exclude the misfortunes; it is protected by a large margin of safety, but does not wholly escape the risk implicit. The average man is advised therefore frankly to face the hazard of mining on a speculative basis rather than to go into it as an investment. On the whole, I would say that a 6 per cent public utility is preferable to a 6 per cent mining bond, but, on the other hand, the speculator will have a better run for his money if he buys the shares of a well-managed young mine in course of development, at a price secured as to 60 or 70 per cent by ore reserves, than in buying the usually heavily watered stocks of other industrial companies.

Minerals Deposited by Bacteria in Mine Water

Observations in the Kimberley Diamond Mines of Peculiar Formations Noted Upon Mine Openings and Appliances—Minute Animal Organisms Held Responsible for Phenomena

By John Parry
Chief Chemist, De Beers Consolidated Mines, Ltd.

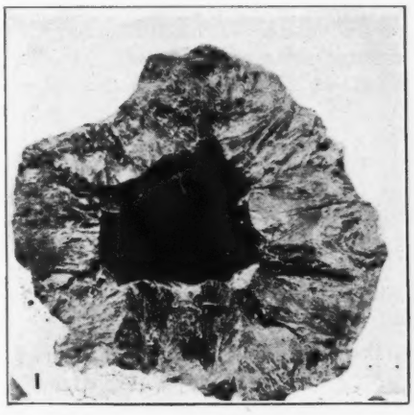
IN NOVEMBER, 1917, several specimens of unfamiliar looking minerals were handed into the laboratory of the De Beers Consolidated Mines, Ltd., for analysis and report. Although work had been carried on in this mine for at least thirty years prior to this date, nothing of a similar nature seems to have been observed before. Indeed, it was not until haulage operations had been discontinued for nearly ten years—viz., since 1908—that their presence had been noted at all.

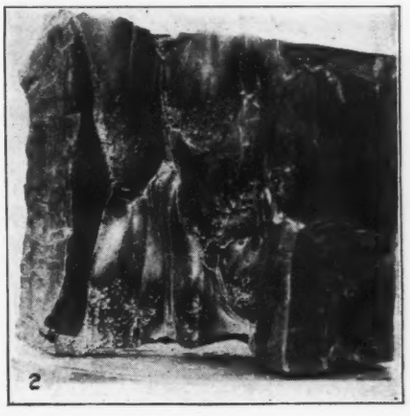
In the Kimberley mine, where mining operations had been curtailed for a briefer period than this, a few small specimens, identical in character and composition to some of those from the De Beers mine, have been obtained from a small cavity in the walls of the shaft. In all the other mines, where work has been maintained uninterruptedly, no such minerals have been known to occur. It is important to note that all these minerals were found either in the shaft itself, or on the floor of certain levels closely adjacent to the shaft.

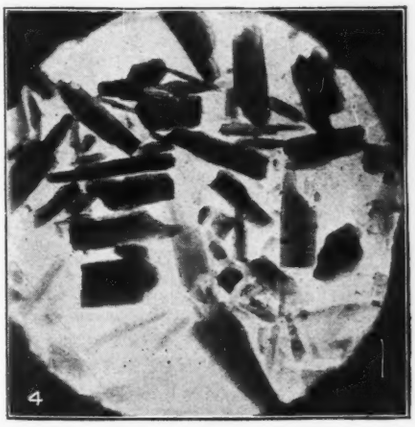
A cursory inspection served to convince anyone familiar with the ordinary minerals found on the numerous working levels of the mine, of the unusual character exhibited by these particular specimens.

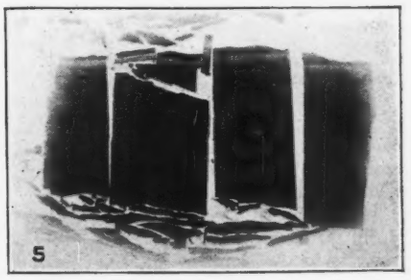
The samples chemically examined, were as follows:

No. 1.—A long cylindrical piece, which formed only a small portion of a huge deposit, found occupying the entire length of a vertical iron pipe, 180 ft. long by 6 in. in diameter, erected in the Prospect shaft of the mine, starting at the 1,860-ft. level and terminating at the 2,040-ft. level. The exterior surface of the cylinder is of an entirely different color than the mass of the core, being a dirty grayish white, whereas the mass is of a deep cinnamon brown. The surface, too, is rough and covered with innumerable shallow depressions; though the interior surface is brilliantly black and with peculiar undulatory oval elevations—i.e., of somewhat botryoidal characters. Figure 1 exhibits the cylindrical outline; and Figure 2 gives a good idea of the interior surface, with the peculiar undulations. The cylinder as shown does not represent the full thickness of this pipe core as originally found, for its total diameter is only 4½ in., whereas the full diameter of the pipe is 6 in. Between this colored part of the core and the pipe wall was another inch or so of a white deposit. This white part was rather soft and so loosely adherent that a vigorous tap with a hammer on the pipe easily detached it, and permitted of the ready removal of entire pieces of the solid core. None of this white part was preserved by the miner who discovered the material. All that remains of it is the dirty white skin just mentioned. This remnant is not particularly soft and adheres pretty









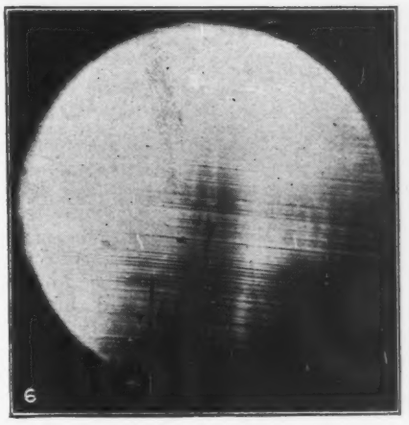


Fig. 1—Cylindrical outline of deposit.
Fig. 2—Interior surface. Note undulations.
Fig. 3—Fragment of rock coated with deposit.

Fig. 4—Powdered pipe deposit under the microscope

Figs. 5 and 6—A portion of the accretion on a stone

firmly to the rest of the core. Sufficient of it, however, was eased off for purposes of analysis. The whole mass of the material is unusually brittle, and possesses a peculiar fibrous appearance.

No. 2.—This sample consisted of thin fragments of a scale which I collected personally on the 1,760-ft. level. The pieces were removed from the surface of some water lying in a depression on the floor of the tunnel. The whole surface of this water was covered with it as with a sheet of ice. There were many other pools and tunnels on this level, all similarly covered. In some there was a bulging of this surface coating, as though considerable pressure was being exerted beneath; and in others there was evidence that this pressure had been great enough to fracture this surface skin, and the fractured parts, being of greater specific gravity than the water, were found lying at the bottom of the liquid, and, when taken from the water, could be fitted into the broken surfaces. The thickness of this skin averaged 1 mm. It was opaque and of a faint brownish tint, and brittle. The pressure alluded to was in all probability due to an accumulation of gas, but at the moment I had no means available for collecting any of it for analysis, and on a subsequent visit I found all the surfaces had been broken. I was unable to obtain any definite information as to the length of time required for this solid skin to form on these pools, for though the mine had been idle for ten years, it was only when the miner, Mr. Waddington, was placed in charge, about seven months prior to my visit, that any observation was made as to the occurrence of this peculiar deposit. From his remarks I assume that possibly only several months were needed for its formation. Analysis gave the following results:

Composition of Sample No. 2

	Per Cent
Calcium carbonate	87.75
Magnesium carbonate	6.34
Silica	1.32
Iron oxide and alumina	0.66
Moisture	2.00
Organic matter	1.92
	99.99

No. 3.—This sample also occurs as sheets covering pools of water of equal thickness to Sample No. 2, but of a uniform blood-red color. Held before a strong light they are semitransparent and of a homogeneous structure. Fragments measuring 12x10 in. were easily procured and were not so brittle as Sample No. 2 and were strong enough to resist any gas pressure from beneath, as all the specimens were perfectly flat. The upper surface was fairly smooth, but here and there on the under side small clusters of minutely globular particles occurred, identical in composition to the sheets. In some places a second sheet had been formed immediately beneath the first in almost optical contact. The insertion of a knife blade, however, between the two sheets caused a clean separation. These samples were found on the 2,040-ft. level only. Analysis showed:

Composition of Sample No. 3

	Per Cent
Calcium carbonate	90.25
Magnesium carbonate	5.46
Silica	0.44
Iron oxide and alumina	0.40
Moisture	0.72
Organic matter	2.16
	99.43

No. 4.—These samples are even more remarkable than the pipe core (No. 1). They consist of fragments of the tunnel rock (so-called basalt) which have become coated while lying on the floor of the tunnel with the same deposit that occurs in the iron pipe. The fragment illustrated in the photograph, Fig. 3, when first discovered, was as completely enveloped with the foreign material as an egg with its shell. The exposed surface of this, like the sample from the pipe, is brilliantly black, and perfectly smooth and glassy. The under side is only a little less bright than the upper, which is accounted for by its lying in contact with the dirty floor of the tunnel, and is also less smooth, as this surface shows an exact impress of the irregular ridges and depressions of the floor, as though it had been pressed down on it in a semisolid condition, like a seal on warm wax. When this black coating was fractured, it was seen (as the photograph shows distinctly) that it consisted of two layers, though curiously enough the surface of the innermost layer was as brilliantly black and glassy as the outer one, and could be easily separated. Evidently the deposition of the second coat must have occurred long after the first. The nucleus of another one of these samples, from which the black coating had been more completely removed, consisted of a piece of the tunnel rock (basalt ?), 6 in. long by 2 in. wide and varying from ½ to 1 in. thick. It was irregular in shape and angular. The two coats varied in thickness: the lower between $\frac{1}{16}$ to $\frac{3}{8}$ in.; the upper sometimes reaching ¼ inch. In spite of the angularity of this stone, the outer surface of the complete specimen was smooth and roughly dome shaped, entirely concealing the irregular shape of the internal fragment of rock. Quite a large number of such specimens were found on this level (1,920 ft.), all exhibiting a similar confluent-surface, and a double coating, and only differing from each other in size.

A First-Hand Field Examination

The occurrence of these deposits struck me as so anomalous that I was curious to see for myself the conditions under which they were discovered. Accordingly, accompanied by one of the laboratory assistants (Mr. Falck) and Mr. Waddington—the miner in charge—I descended this De Beers mine in March, 1918. We descended the Prospect shaft by cage to the 1,720-ft. level, and continued from that point by upright iron ladders to the 2,040-ft. level, spending some time at various levels on the way down. The most interesting of these levels was that at 1,920 ft. The part of the tunnel immediately adjacent to the shaft was about 9 ft. high and 14 ft. wide. Here, on the floor, we came across the first samples of the black shiny deposit in the process of formation. Scattered indiscriminately over the floor were fragments of the tunnel rock and pieces of wood and iron; some were already completely enveloped in the black coating, others partly so, and again others showing the initial stage of the deposition. And the source of all this abnormal formation was just water; water as it fell in intermittent drops from various parts of the roof. At first it appeared that this water was percolating through the rock from an upper level, but subsequent examination of the water afforded evidence that this could not be so. It was really derived from water rapidly streaming down the walls of the shaft itself, some of which, on reaching the opening of this level, would be carried along the roof between the innumerable minute ridges by capillary attraction, and fall ultimately and irregularly as drops. Beyond 6 ft. from the shaft no drippings at all occurred, though the tunnel was composed of the same kind of rock for many yards further in.

Bottles were placed beneath the more rapidly falling drops, and a gallon of this water was collected. On analysis, this water yielded the following data:

Mine Water Analysis

In Parts per 100,000

(a) Bases and Acids	Parts	(b) Probable Combinations	Parts
Calcium oxide	3.08	Calcium carbonate	5.50
Magnesium oxide	1.00	Magnesium carbonate	2.10
Sodium oxide	339.60	Sodium carbonate	133.58
Potassium oxide	1.41	Sodium sulphate	532.65
Silica	2.70	Sodium chloride	53.98
Iron oxide and alumina	1.70	Potassium chloride	2.69
Carbon dioxide	58.96	Silica	2.70
Sulphur trioxide	300.09	Iron oxide and alumina	1.70
Chlorine	34.00		
	742.54		
Less oxygen to Cl	7.66		
	734.88		734.90

Organic matter was also present. The stone illustrated in Fig. 3 and all the samples alluded to in No. 4 were picked up on this level while the water was still dripping on them. Here, too, the upper end of the pipe which had contained the core illustrated in Figs. 1 and 2 was exposed. Seven months prior to my visit this opening had been covered over with a plank, and during even that short period the continual dripping of the water had produced on its surface a thin deposit consisting of the same peculiar black material as upon all the other samples.

Deposition on Ladder Rungs and Rope

From this point we descended to the 2,040-ft. level by the iron ladder. Water was trickling down this ladder continuously, and all the rungs were completely covered with the black deposit, the lowermost ones being perfectly smooth and extremely slippery. Portions of the coating were chipped off for analysis. At the bottom of the shaft (2,040 ft. down) there lay a mass of contorted wire rope, which looked as if it were covered with molten pitch, so bright and black was it from long accumulation of this deposit. Samples of this black deposit were isolated from the (1) "pipe core," (2) "the stones," (3) the "plank of wood," and (4) the "iron rungs" of the ladder, and separately analyzed. The composition of them all is practically identical, as may be seen from the following results:

Black Deposit Analysis

In Per Cent

	(1) Sample From Iron Pipe	(2) Sample Covering Stones	(3) Samples Off Plank of Wood	(4) Sample From Rungs of Ladder
Calcium carbonate	82.56	89.50	89.00	88.6
Magnesium carbonate	8.77	5.81	5.20	5.9
Silica	0.38	0.14	0.40	0.2
Iron oxide and alumina	2.80	0.14	0.28	0.8
Moisture	3.92	1.83	0.90	1.3
Organic matter	1.71	2.66	1.56	2.6
Sodium sulphate	Trace	Trace	2.55	Trace
	100.04	100.08	99.89	99.4

Some samples contained traces of P_2O_5 and NH_3. The weight of material found in the pipe was approximately estimated. The specific gravity was 2.6, and its average thickness two inches. The pipe was six inches in diameter, and its length 180 ft., the whole of which was coated internally with this deposit. Calculated out, this indicates a weight of 3.64 tons. There is at least 200 lb. of it which consists of organic matter. Reverting to the analysis of the water which produced this deposit it will be seen that the amount of carbonate of lime and magnesia present is ridiculously small, and only slightly exceeds their actual solubility. To produce this 3.64 tons of deposit, nearly fourteen million gallons of this water would be required; and further, it would be necessary to evaporate it to complete dryness; and to accomplish this in ten years would mean that 2½ gal. must be dissipated every individual minute. There exists the possibility that at various times during this period of ten years the lime content of these waters may have exhibited great fluctuations. Unfortunately, no records are available of any analyses having been performed on these waters between 1908 and 1917. In 1906, however, Dr. Otto Hehner examined an alkaline water from this mine, and this showed only 6.2 parts $CaCO_3$ per 100,000.

Since 1917, at least six samples have been analyzed and at intervals of twelve months and two months; but the range was always low, varying from 1.2 parts up to, but never exceeding, 7.2 parts per 100,000. It does not seem feasible that such rapid evaporation could take place in a vertical pipe of the specified diameter, and at a temperature only a few degrees above the normal—about 20 deg. C. Further, if the pipe were filled with flowing water, the evaporation would be negligible, and if it merely trickled through—which appears to have been the normal condition—there would certainly be some evaporation: but even assuming it to be so large as 10 per cent, no appreciable deposition of carbonate of lime would be induced from so weak a solution.

A reasonable conclusion here is that a theory depending wholly and solely on evaporation is inadequate to account for so large a deposit in so short a time. Confirmation of this inference may be justified by the following instances:

On the 1,600-ft. level in the Wesselton mine there is a 3-in. *horizontal* iron pipe, which has been delivering a stream of water into the main rock tunnel for the last seven years, at the rate of 1,200 gal. per hour. It is not a mightily rushing torrent (for the pipe is always much less than half full), so that a large surface is continuously exposed to atmospheric friction, thus favoring evaporation. The amount of lime and magnesia in the water is nearly twice that of the De Beers sample. At least 73,000,000 gal. of water, carrying 36½ tons of lime, has passed through that pipe in that period, and yet there is no appreciable deposition of lime in it. Here the conditions of flow and the lime content of the water are far more in favor of a copious deposit than in the De Beers case, and yet none occurs.

A second instance: At the company's central power station the water used in the condenser has the composition shown below:

	Parts per 100,000
Calcium carbonate	2.59
Magnesium carbonate	0.77
Sodium carbonate	9.66
Sodium sulphate	8.38
Sodium chloride	27.48
Silica, iron oxide and alumina	3.29
	52.17

It varies a little from time to time. Say the average is 5.5 parts of lime per 100,000. The average daily flow of this water through the condenser is 9,000,000 gal. The condenser has 4,000 tubes and exposes a cooling surface of 13,000 sq.ft. The temperature reached is well over 38 deg. C. and often reaches 60 deg. C., quite high enough to drive off nearly all the semicombined CO_2, which holds most of the lime in solution. Yet with all these favorable conditions for deposition, it takes two years for a scale one-fortieth of an inch to form. It amounts to only 0.13 per cent of the total lime in solution.

Other Reasons for Mineral Formations

If, in the De Beers mine sample, then, the temperature of the water could have been maintained at 38 deg. C. and had been flowing through a horizontal instead of a vertical pipe, it would have yielded only 9½ lb. of deposit, instead of over 7,000 lb. That is, in the absence of any other contributory cause for the precipitation. That some other cause than evaporation was operating seemed to be evident, though at the time I could not trace it, and the matter was left in abeyance for some time.

An opportunity subsequently presented itself for a

further examination of the water causing the deposit. It was collected again as it dripped from the roof; it was quite clear and free from any suspended matter. The chemical character of the dissolved ingredients *coincided with those of the original water.* On this occasion, interruptions in the operations of analysis necessitated leaving the bottle, with half its contents, undisturbed for several days on the laboratory bench. It was then observed that all down the side remote from the light, a grayish white deposit appeared, which adhered most tenaciously to the glass. The bottom of the bottle was similarly coated, but with a much thicker layer. The most violent agitation of the bottle failed to disturb either of these adhesions. The bottle had remained securely corked all this time, so that no evaporation nor loss of carbon dioxide could occur; and the fact should be emphasized that when originally collected the water was clear and free from any suspended matter. The water was poured off and some of the grayish deposit scraped up for examination. When treated with dilute hydrochloric acid, the substance effervesed vigorously, and subsequent analysis showed it to contain a high percentage of carbonate of lime. This was a rather phenomenal result. Here was a deposition of carbonate of lime occurring without any evaporation whatever, without any loss of carbon dioxide, and with no chemical present to assist precipitation, nor any increase of temperature; and yet it occurred in a homogeneous semitransparent condition.

The Microscope Exposes the Cause

Naturally, a microscopical inspection suggested itself. Several slides were prepared and viewed with a ⅛-in. objective, and inspected critically, for there at last appeared to emerge a hint suggesting an important contributory cause—perhaps the sole cause—in the formation of these weird deposits. The field of view was occupied with myriads of living micro-organisms; some quiescent, but many more exhibiting considerable motility. Both micrococci and bacilli were present, and it could be discerned, when viewed with special care, that each of the bacilli was surrounded with a transparent gelatinous envelope. It appears to me highly probable that it is the presence of this sticky jacket that enables these organisms to adhere so strongly to the glass of the bottle, or, for that matter, to anything else.

It would appear from this striking revelation that we have discovered a micro-organism capable of withdrawing calcium carbonate from solution and building it up into its own tissues, *unaltered*; a sufficiently novel and startling inference. If this inference, however, be justified, then it assists most materially in accounting for the accumulation of such phenomenal deposits, both in the pipe, on stones, and elsewhere. It occurred to us to ascertain if the colored deposit from the stones and the pipe could yield any evidence that these particular bacilli might be lying dormant in this dry material. Some of the material was gently crushed, placed in a sterile test tube, covered with sterile water, the tube plugged with sterile wool, and then incubated for several days at a temperature of 21 deg. C. A similar tube, as control, was prepared under identical conditions, except that powdered native calcite was substituted for the colored deposit, and incubated at the same time and temperature. After five days, portions were drawn off from each tube, and inspected microscopically. The "control" tube sample showed only calcium carbonate, nothing more; no living micro-organisms, neither bacilli nor micrococci; but imagine our surprise and delight when the "deposit" sample revealed a crowd of living organisms, resembling those that had been obtained from the water itself: crowds of active micrococci and crowds of the tiny jacketed bacilli.

If these bacilli, then, be responsible for the extraction of calcium carbonate from the water, the adhesion of the deposit to the side of a vertical pipe does not now seem so surprising. For once a gelatinous colony of these organisms became attached to the pipe it was not easily dislodged; and, the start once made, further accumulation was inevitable. The conditions of deposit and further growth, were, in a way, ideal: there was darkness; there was a suitable temperature (about 70 deg. F. on the average); there was organic matter in the water to serve as food; and there was calcium carbonate for tissue building. To put it in the crisp brief way of the scientist, the whole conditions constituted a suitable nidus[1] for the propagation of saprophytic[2] organisms.

At this period of the investigation (in the absence of opportunities for further biochemical experimenting), this inference of bacterial agency struck me as being too audacious to serve as more than a tentative explanation. The work was left in abeyance for some time, but in *Nature* for August, 1920, there appeared the full address of the president of the British Association, Professor Herdman, and in it appeared this remarkably apposite paragraph:

> "The part played by bacteria in the metabolism of the sea is very important, and probably of wide reaching effect, but we still know very little about it. A most promising young Cambridge biologist, the late Mr. G. Harold Drew, now unfortunately lost to science, had already done notable work at Jamaica and Tortugas, Florida, on the effects produced by a bacillus which is found in the waters of these shallow tropical seas and in the mud at the bottom; and which dentrifies nitrates and nitrites, giving off free nitrogen. He found that this *bacillus calcis* also caused the precipitation of *calcium carbonate* on a large scale in the warm shallow waters. Drew's observations tend to show that the great calcareous deposits of Florida and the Bahamas previously known as 'coral muds' are not, as was supposed by Murray and others, derived from broken up corals, and shells, but are minute particles of carbonate of lime, which have been precipitated by the action of these bacteria."

Bacteria the Active Agency

After Mr. Drew's results, there appears now nothing anomalous in inferring the assistance of bacteria in producing such deposits as ours, and I am tempted to infer that it is the persistent activity of such organisms—be their origin what it may—over this long period of time that has been largely operative in producing them.

I do not claim that we have secured the actual *bacillus calcis* of Mr. Drew, but we do at any rate appear to have met with an organism possessing somewhat similar functions.

Further interesting features were observed, when some of the pipe deposit was finely powdered and examined under the microscope. Innumerable parallel striations were visible on nearly every particle; the spaces between them measuring from 1/600 to 1/2,000 of an inch (Fig. 4). By carefully adjusting the focus, the fractured ends of many of these particles presented a series of little steps, revealing their structure as

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[1] A place of development for spores.—Editor.

[2] Any organism living on dead or decaying organic matter.—Editor.

composed of extremely thin layers superimposed one upon another, and each of these thin layers was quite homogeneous and almost transparent.

A thin portion of the deposit from one of the stones was cut off at right angles to the surface, and ground down to a tenuity suitable for microscopical inspection (Fig. 5). Owing to the brittle nature of the material, the preparation of this slide was a tedious operation and required the most delicate and patient handling. Even now the photograph is not so good as one could wish, and only a tiny portion of the mounted specimen was sufficiently thin to allow a photograph being taken through the microscope (Fig. 6). This affords some idea of the great number of layers that has gone to build up this mass.

The only feasible explanation that I can offer for the deposition of these extremely fine layers one upon the other is that it is the work of these same micro-organisms. When first observed in our bottle of water, they had produced on the glass an extensive transparent adhesive film of matter. This water was collected as it dripped from the roof. The stones were coated by the same process of dripping. Each drop falling on the more or less flat surface of a stone tends to flow all over it, thus at the same time evenly distributing its micro-inhabitants. As a result of the intense activity of such myriads of organisms it is not long before a strongly adherent, thin confluent film of calcareous matter is produced. By the time another drop falls on the same spot, a bed or layer of the earlier drop is established, and the second drop then proceeds to repeat the process, and thus layers are produced continuously, though slowly, one upon another, with every succeeding drop that falls on the stone. It is to be noted, in view of the rather considerable area of the roof over which the water trickles, that the fall of drops seems fairly rapid; but the dropping is very uneven, so that a drop seldom falls from the same place except at long intervals. It is not surprising, therefore, that a great deal of time is required to produce even ¼ in. of these deposits on any one article.

There are of course alternative natural processes which suggest themselves as probable causes of such deposits. Stalactitic formations sometimes show very thin concentric layers; but these are undoubtedly produced by a process of evaporation and from fairly strong solutions of bicarbonate of lime; but such evaporation seems to be ruled out in the case of our samples. Moreover, none of these deposits ever assume stalactitic form.

Travertine, too, and other native forms of calcium carbonate, are assumed to form from the action of certain algæ, which, by absorbing the semicombined CO_2, in the absence of free CO_2, causes $CaCO_3$ to fall out of the solution. This cause is not excluded here, though, so far, no evidence has turned up in support of it. Again, too, the algæ do not absorb the calcium carbonate into their structure, whereas the organisms found on the sides of our bottle can be easily shown to consist largely of the calcium carbonate. However, further bacteriological work is being carried out in connection with this matter.

How Color Is Accounted For

Still another problem is presented by these anomalous deposits which requires elucidation—viz., the color of the mass and the brilliantly black surfaces. What is this coloring matter and whence derived?

When fragments of the pipe core were shown to individuals curious enough to speculate as to their nature, they usually declared, without hesitation, that it was a specimen of crocidolite (cat's-eye stone). After only a superficial microscopical inspection, this is not an entirely unreasonable suggestion, as the polished pieces of it do strikingly simulate that native mineral. Its fibrous structure and color are, however, the only features it possesses in common with crocidolite. Its brittleness and chemical composition sufficiently indicate that it cannot be this substance.

Another suggestion, offered by some who were acquainted with its source, was that it was derived from the insulating material of old electric cables lying in the mine. This was quite feasible, and operations were conducted to decide this point. The substances that would be removed from such material by a soda alkaline water (such as this water is) are resin and shellac. There are excellent chemical tests for identifying these two bodies, but after separating the organic matter from the calcium carbonate by a special method and submitting it to these particular tests, the answer, as a cabinet minister would say, was in the negative. The electric-cable origin may therefore be eliminated from further consideration.

A third suggestion was that it was the fossilized trunk of a tree. When a long piece of the pipe core is inspected, it does rather resemble a tree stem with the central portion removed. But, of course, fossilized trees do not grow in modern 6-in. iron pipes in diamond mines.

After inspecting these various deposits in place, two probable sources of this coloring matter seemed obvious: it may have been derived from rotten timber, from soluble portions of animal excreta, or from both. Both occur in the mine, and in contact with a water containing so active an alkali as carbonate of soda, some of them would be carried into solution.

The fact, that practically all these colored deposits occur in the immediate vicinity of the shaft, where there is always much timber, and trickling alkaline water, at once suggested a ligneous origin for this color.

A great deal of work was performed to prove this point, though less would have sufficed, had it not been for the other obvious alternative. The evidence for the influence of excrementitious matter was slight and therefore inconclusive; the presence of small quantities of ammoniacal compounds and traces of phosphate of lime being the only indications. Moreover, these were not present in all the samples that were operated on. Attention was therefore mainly devoted to confirming the woody origin.

Organic Chemical Bodies Responsible

There are a great number of definite and indefinite chemical bodies existing in wood, of which some are exceedingly complex; and to isolate and identify them all would occupy far more time than can be spared in a busy laboratory, and it would, besides, be quite unnecessary.

Cellulose is a substance that is derived entirely from vegetal matter. It is a product of the so-called metabolism of living plant tissues; so that, if we meet with a substance in an alkaline water, which, after isolation, responds to the generic tests for celluloses, we may reasonably conclude that that water has been in contact with woody matter in some stage of its travels; and if, further, we can isolate the same kind of

substance from the actual deposit, which we know to be derived from the water, the inference is again perfectly logical that some, at any rate, of this organic matter has been acquired from the same source.

Not unduly to enlarge this report, I may state as a result of many carefully conducted experiments and tests, that I was able to isolate from both the water and deposits an organic substance which exhibited all the characteristics of a cellulose material. This result was further confirmed in another way. Some of the decayed timber, which was brought from the mine, was digested with water containing carbonate of soda (N/20), thus imitating as far as we could the conditions we imagined to have occurred in the mine. When the organic matter derived from the timber by this means was isolated from the water and tested, precisely the same results were obtained for cellulose material as in the original samples.

We may now therefore state unequivocally that the unusual color of all these deposits is derived from decaying timber after contact with an alkaline water.

As a final proof that these alkaline waters do come in contact with timber, the slight muddy deposit that was obtained from one of the samples of alkaline water that was collected as it trickled down the walls of the shaft was examined by means of the microscope. Every portion inspected revealed the presence of many tiny particles of organized structure, such as "cells with bordered pits" and fragments of medullary rays so characteristic of coniferous or pine wood, and of pine wood only, as used in the shaft timbering.

The New Element, Hafnium*

Discovered by X-Ray Spectroscopic Methods Following Bohr's Atomic Theory— An Associate of Zirconium

BY DR. D. COSTER AND DR. G. HEVESY

THOUGH the great majority of the elements exhibit conspicuous differences in their chemical behavior, we find as we proceed from hydrogen to uranium that we suddenly meet a group of chemically closely related elements, the so-called rare-earth group, the members of which exhibit so close a resemblance in their chemical properties that their separation involves great difficulties.

Why does the normal sequence of the elements in the natural system get interrupted through the sudden appearance of the rare-earth group? This question could be first answered by the quantum theory of the atomic structure proposed by Bohr. Starting from Rutherford's nucleus atom and the so-called quantum theory of radiation, he has shown that what we call the atom's chemical properties are determined by the number and the arrangement of the electrons of the atom and chiefly by the number and arrangement in the outermost group of electrons. When proceeding from hydrogen to uranium in general we meet appreciable differences in the outermost group of electrons of two neighbor elements: hence the marked difference in the chemical behavior of these elements. It has been shown, furthermore, by Bohr that we have to encounter at a certain place in the periodic table a group of elements the members of which only show differences in the constitution of the deeper-lying electron groups of their atoms. To such differences in the inner groups correspond only small differences in the chemical behavior; hence the great similarity in chemical behavior of the elements within the group of the rare-earth elements.

According to Bohr's theory this successive change in the inner groups of electrons happens in the interval between lanthanum (57) and lutetium (71). The element of atomic number 72, however, should, according to the theory, already show in the constitution of the outermost electron group of its atoms differences from the foregoing one—i.e., the element 72 should exhibit properties entirely different from those of the rare-earth elements and be a proper analogue of zirconium.

In 1911 Urbain detected the presence of several unknown spectral lines in a preparation of rare-earth elements, and, based on this evidence, and on certain measurements of the magnetic properties of his preparation, he announced the discovery of a new rare-earth element, celtium. About half a year ago, by investigating Urbain's preparation, using Moseley's method of X-ray spectroscopy, Dauvillier found two exceedingly faint lines in the region where the characteristic X-ray lines of the element 72 should be expected, and announced on the basis of this measurement that celtium is identical with the missing element of the ordinal number 72. This announcement could not be reconciled with Bohr's theory. To settle this point of utmost interest for the theory we tried to find an element which is a proper analogue of zirconium and has the number 72.

By investigating zirconium minerals with the aid of Moseley's method we ascertained the presence of a new element in appreciable amount, ranging from 2 to 20 per cent in all minerals investigated, including specimens from Norway, Greenland, Italy, France, Russia, Ceylon, Brazil, and North Carolina. Also, in all commercial "pure" zirconium preparations the presence of at least 1 per cent of the new element could be revealed. The determination of the exact wave length of eight characteristic X-ray lines gave the conclusive evidence that the new element has the atomic number 72. By using suitable methods to separate zirconium from thorium and titanium, we succeeded in isolating the new element called hafnium (Hafnia = Copenhagen) from zirconium. Hafnium could easily be separated from the rare-earth elements, and apart from this the determination of the optical spectrum of hafnium, which has been found entirely different from the optical spectrum found by Urbain for celtium, affords conclusive evidence that hafnium is entirely different from celtium.

The chemical properties of hafnium lie closer to zirconium than to their other neighbor in the fourth vertical column of the periodic table, thorium. The high melting point, high power of light emission of the oxide, and the electron emission of the heated metal exhibited by zirconium are also shown by hafnium and the corresponding hafnium compounds. How far the latter have properties which, from the industrial point of view, are more advantageous than those of the corresponding zirconium compounds further investigations will reveal.

Hafnium is abundant enough to be used for industrial purposes; it is found fairly concentrated in common zirconia and other zirconium minerals.

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Rotation Mechanisms for Rock Drills

Description of Devices Developed to Impart Rotary Movement to Steel of Power-operated Drills—Piston and Hammer Types Considered

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Royal J. Day

KNOWLEDGE of and familiarity with typical mechanisms designed for the purpose of rotating drill steel of power-operated rock drills are of advantage to the practical engineer and operator. Only those that have proved satisfactory and that have been standardized by manufacturers will be included in this article.

The purpose of rotating rock drills steel is well known to all who are interested in drilling, but a few words of explanation for the benefit of those who are not familiar with the operation of the machine may be appropriate.

In the piston type of drill, the drill steel is clamped rigidly in a chuck which is attached to the piston rod of the drill and is reciprocated by the movement of the piston in the cylinder. This action of the piston is due to the application of compressed air or steam under pressure to the front and back ends of the piston alternately. By the proper "feeding" of the drill, the bit is made to strike the rock on each forward stroke of the piston.

In the hammer type of drill the conditions are somewhat different. In this type the bit end of the drill steel is held lightly against the rock by proper feeding of the machine, and the shank end of the steel is held in a chuck so constructed that when the chuck parts are rotated by the rotation mechanism the steel will also be turned. In the hammer type of drill the steel does not reciprocate, but the piston is so designed that a blow is struck against the shank end of the drill steel on each forward stroke of the piston. The force of the blow is conveyed through the drill steel to the bit. Care must be used in feeding the drill so that the bit is not held too tightly against the rock. If this is done it will result in excessive wear to the cutting edges of the bit.

Chucks for Hammer Drills

A better idea of the construction of the chuck will be had by referring to Fig. 1. The driving lugs are formed directly in the chuck sleeve *D*. The chuck front-bushing *C* is made to receive the desired size of steel and is held in place by means of the chuck nut *A*, which is screwed tightly into the chuck sleeve *D*, and holds the chuck front bushing *C* in place by means of the chuck back-bushing *B*, which acts as a filler piece.

The chuck key *E* acts as a retainer to hold the steel in the chuck after it has been placed in operating position.

There is also a type of chuck used which is known as the anvil-block chuck. This chuck is provided with an anvil block upon which the force of the blow of the moving piston is delivered. The anvil block is held in contact with the drill steel by proper feeding of the machine, and the force of the blow delivered is thus conveyed to the drill steel, the bit end of which is held in contact with the rock. The anvil block used is limited in regard to travel, and, by the use of this chuck, it is possible to use drill steel without collars or other means to prevent the steel from entering too far into the drill. Chuck front-bushings can be furnished for any of the various standard sections of steel.

Drill-Steel Shanks for Hammer Drills

The most commonly used shanks for hammer drills are shown in Fig. 2 and Fig. 3. Fig. 2 also shows a section through the driving lugs of the chuck sleeve and driving lugs of the drill steel of hammer drills using the type of shank shown.

In Fig. 2 is shown the type of shank which is generally used with the mounted type of hammer drill. The driving lugs *A* are forged on the drill steel and engage with the lugs *B* in the chuck sleeve, which cause the drill steel to turn when the chuck is rotated. The

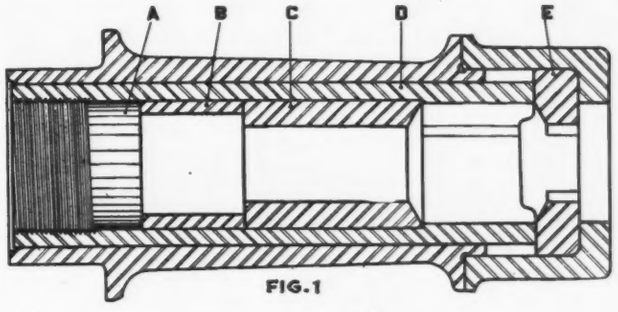


FIG. 1

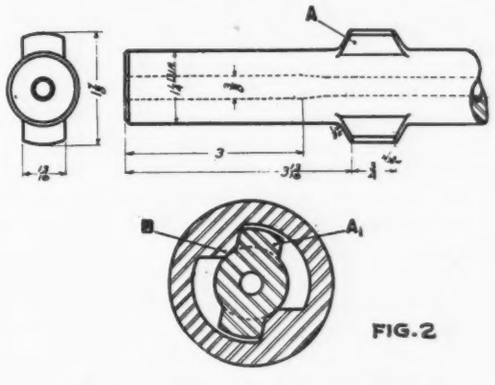


FIG. 2

Fig. 1—Chuck for hammer drills

Fig. 2—Shank of hammer-drill steel and section through chuck sleeve and driving lugs

lugs on the steel also act as a stop to prevent the steel from entering too far into the drill, which would result in shortening the stroke of the piston and thus reduce the efficiency of the machine. The chuck is so constructed that when the steel has been properly inserted in the chuck, a slight turn of the steel will cause it to be locked in position, so it will not become disengaged during the operation of the machine.

Fig. 3 shows the shank that has been almost universally adopted for use with hand hammer drills of the Jackhamer type, and corresponding drills. This shank is made of hexagon steel, on which is formed a collar shown at *A*, which prevents the steel from entering too far into the drill. The part of the chuck of the machine into which the shanks fit is made of the proper shape, or is provided with proper bushing so the steel is turned when the chuck is rotated.

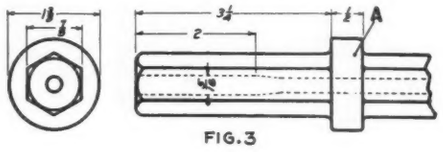


FIG. 3

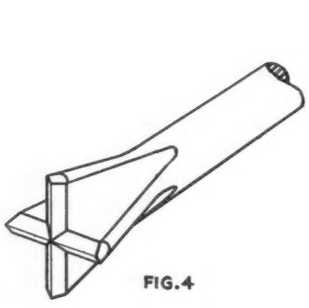


FIG. 4

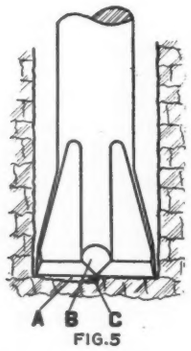


FIG. 5

Fig. 3—Shank of drill used in light hammer drill

Fig. 4—"Cross" drill bit

Fig. 5—Showing the principle involved in drilling

Fig. 4 shows the drill bit generally used for rock drilling. It is known as the "cross" bit. There are, however, various other types of bits, such as the "X," "six point," "chisel point," "double arc," and "Carr." All of the different types of bits are in more or less general use; some are better adapted for the various grades of rock than others, but reference to the "cross" bit will serve for this article. When drilling, the hole is not made by cutting the material, as is generally understood by the term; the rock must be broken away by the impact of the bit.

It is evident that if there were no rotative movement of the bit, the force of every blow would be delivered to exactly the same place on the rock, with the result that the rock directly under the cutting edge of the bit will be pulverized, but no actual progress toward deepening the hole would be made. But if the bit is rotated, or moved so the cutting edge is advanced to a new position after the delivery of each blow, progress toward deepening the hole will be made.

The above may be better understood by reference to Fig. 5, wherein the cutting operation is shown, somewhat exaggerated for the purpose of illustration. At *A* in Fig. 5 is shown a representation of the indentations made by the force of previous blows delivered upon the rock. *B* shows the bit rotated to a new position. *C* shows the rock being broken away under the force of the blow.

Rotation Mechanism of the Piston Drill

Fig. 6 shows the design of rotation mechanism that has been adopted by practically all of the manufacturers of rock drills for use with piston-type drills. *A* is the rotation ratchet which is kept from turning by the friction caused by clamping it between the back head *F* and the rotation washer *G*. The rifle bar *E* has a projection in which is cut spiral grooves *E*-1, which fit over corresponding spiral teeth in the rifle nut *H*, which is screwed tightly into the piston *I*.

The rifle bar *E* is free to rotate in the direction indicated by the arrow, but is prevented from turning in the other direction by the action of the rotating pawls *D*, which are held in place in the teeth *A*-1, of the rotation ratchet *A*, by the pawl plungers *C*, and the tension of the springs *B*.

For the purpose of explanation, we will assume that the rotation of the drill steel takes place on the back stroke of the piston *I*. When the piston *I* is moved toward the front head *J*, the rifle bar *E* will be turned in the direction indicated by the arrow at section *XX*. On the back stroke when the piston *I* travels toward the back head *F*, the rotation pawls *D* are held in place in the teeth *A*-1 of the rotation ratchet *A* by the pressure of the rotation pawl plungers *C* due to the tension of the springs *B*. This prevents the rifle bar *E* from turning in a counter-clockwise direction, with the result that the piston *I* will be turned by the action of the spiral teeth of the rifle nut *H* sliding in the spiral grooves *E*-1 which are cut in the rifle bar *E*. The drill steel *S*, which is clamped securely in chuck *K*, will thus be turned a fraction of a revolution at each complete cycle of the piston *I*, the amount depending upon the lead of the spiral grooves *E*-1 and the length of the stroke of the piston *I*.

Whether the rotation of the drill steel takes place on the back stroke of the piston, as just described, or on the forward stroke, is optional with the manufacturer of the machine. I prefer to have the rotation of the drill steel take place on the back stroke of the piston, acting on the theory that the work of rotating the piston and drill steel is much greater than that required

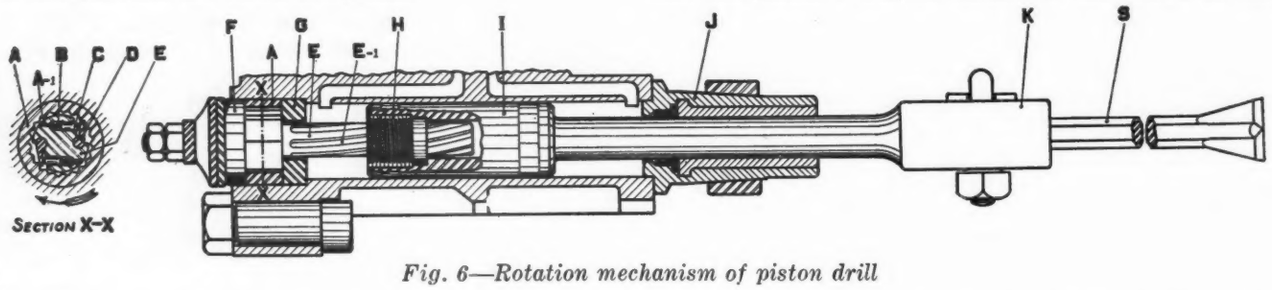


Fig. 6—Rotation mechanism of piston drill

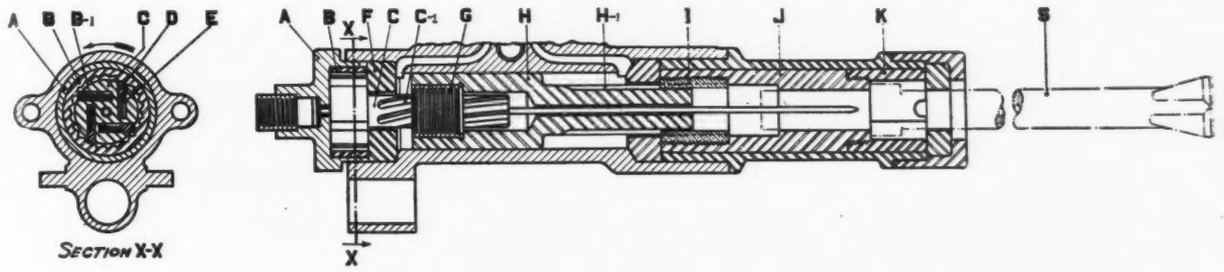


Fig. 7—Rotation mechanism for hammer drill—rifle-bar type

to turn the rifle bar only. It follows that there will be less drag on the piston, and a more forceful blow will be delivered by the drill bit upon the rock, if back-stroke rotation is used.

Rotation Mechanism for Hammer Drill—Rifle-Bar Type

The principle of the hammer drill (previously described) has now become standard for drills of this type; that is, the bit of the drill steel is held lightly against the rock by proper feeding of the machine, and the piston, or hammer, delivers the blow against the shank end of the drill steel, which is held in the chuck of the machine. The force of the blow is conveyed through the drill steel to the bit.

In Fig. 7 is shown a rotation mechanism for hammer drills. This mechanism is operated by means of a rifle bar. Certain functions of the rotation shown in Fig. 7 are identical with those previously described for the piston-type drill shown in Fig. 6. Referring to Fig. 7, the piston *H* is rotated by means of the spiral grooves *C*-1, in the rifle bar *C*, in which slide the spiral teeth of the rifle nut *G*, which is screwed tightly into the piston *H*. The rifle bar *C* is free to turn in the direction shown by the arrow, but is prevented from turning in the opposite direction by the pawls *D*, which are held in place in the teeth *B*-1 of the rotation ratchet *B*, by the tension of the springs *E*. It will thus be seen that the piston *H* will be rotated at each complete cycle of the piston, the amount of rotation depending upon the lead of the spiral grooves *C*-1, which are cut in the rifle bar *C*, and the stroke of the piston *H*. The rotation ratchet *B* is prevented from turning due to the friction caused by clamping same between the back head *A*, and the cylinder back-washer *F*.

The front or striking end of the piston *H* has a series of straight grooves *H*-1 cut in same, which fit over straight teeth in the chuck nut *I*, which is screwed tightly into the chuck sleeve *J*. By this means the chuck sleeve *J* is made to rotate the same as the piston *H*, and by so doing will rotate the drill steel *S* by means of the lugs on the shank of the steel engaging driving lugs which are formed in the part of the chuck shown at *K*, which is firmly attached to the chuck sleeve *J*.

Attention is called to the rotation pawls *D* in Fig. 7, which differ considerably from those shown in Fig. 6. Those shown in Fig. 7 are made of rectangular section of steel, and are held in engagement by the pressure of the springs *E* acting directly upon them.

The rotation mechanism shown in Fig. 8 varies considerably from the one just described. In the machanism shown in Fig. 8 the piston or hammer is prevented from turning in the cylinder by means of the dowel or key *A*, which is held in place in the cylinder as shown. The piston *B* is provided with a straight groove *B*-1 which fits over the key *A*. In the front end of the piston *B*, eight left-hand spiral grooves *B*-2 are cut, which fit over corresponding spiral teeth *C*-1 in the rifle bushing *C*. The rotation ratchet *D* is provided with driving lugs *D*-1 which fit into recesses machined in the chuck *E*. By this means any rotative movement on the part of the rotation ratchet *D* is transmitted to the chuck *E*.

The rifle bushing *C* is free to turn in the direction shown by the arrow, but is prevented from turning in the opposite direction by the rotation pawls *G*, which are held in place in the teeth *D*-2, of the rotation ratchet *D*, by means of the pawl plunger *F* and the tension of the springs *E*.

When the piston *B* is moved toward the back head and is prevented from turning by the straight groove *B*-1 sliding over the key *A*, the rifle bushing *C* will be rotated in the direction indicated by the arrow. On the forward stroke of the piston *B*—that is, when the piston moves toward the front head of the machine—the rifle bushing *C* is prevented from turning by the rotation pawls G, which are held in place in the teeth *D*-2 of the rotation ratchet *D*, as previously described. Rotative motion will thus be transmitted to the rotation ratchet *D*, which will in turn cause the chuck *E* to be rotated by means of the lugs *D*-1 which engage in the recesses machined in the chuck *E*.

The chuck *E* is machined to the desired size and sectional shape to correspond to the shank of the drill steel *S*. As the sectional shape of the steel is such that it cannot be turned in the chuck *E*, any rotative movement of the chuck will be accompanied by a like movement of the drill steel *S*.

The amount of rotative movement that is required will vary considerably for the different grades of rock that is to be drilled, some rocks being cut to better advantage if a fast rotation is used; more efficient work

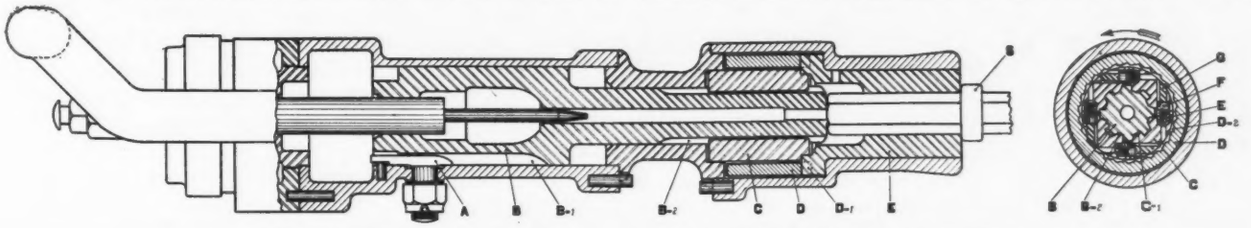


Fig. 8—Rotation mechanism for hammer drill—locked-piston type

is obtained in some localities by the use of a slower rotation.

In the mechanism just described, the lead of the spiral grooves *B*-2 which are cut in the piston *B* is one turn in 36 in. The working stroke of the piston *B* is approximately 2⅛ in. The amount the drill steel *S* will be rotated at each complete cycle of the piston is found to be (360 ÷ 36) × 2.125 = 21¼ deg., or approximately one revolution of the drill steel for every seventeen striking strokes of the piston *B*.

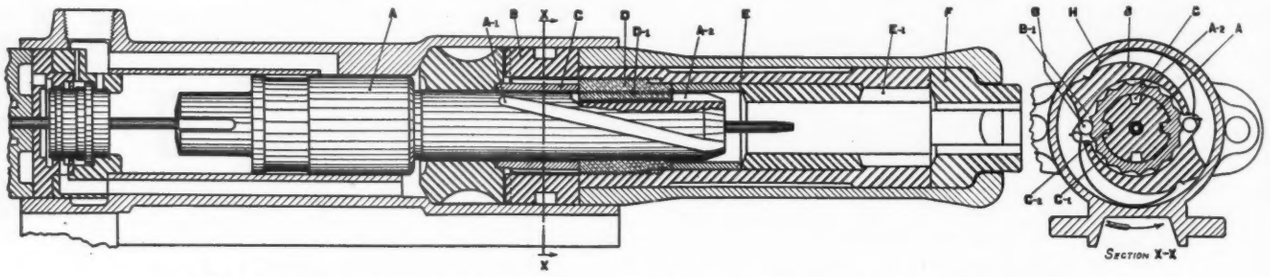


Fig. 9—Rotation mechanism for hammer drill— front-end-piston operated type

Rotation Mechanism for Hammer Drills—Front-End-Piston Operated Type

Various types of rotation pawls have been used with the rotation mechanisms of rock drills. A departure from those that have previously been described is shown in Fig. 9. The roller type of pawl shown in Fig. 9 depends upon the wedging action of the pawl between the serrations *C*-1 of the rifle bushing *C*, and the tapered surface *B*-1 of the rotation bushing *B*, to prevent the rifle bushing *C* from turning in a clockwise direction. The tension of the springs *H* hold the pawls in position in the serrations *C*-1, thereby insuring proper action of the pawls.

The front end of the piston *A* has two spiral grooves *A*-1 and two straight grooves *A*-2 cut in same. The spiral grooves *A*-1 fit over spiral teeth *C*-2 in the rifle bushing *C*, and the straight grooves *A*-2 fit over straight teeth *D*-1 in the chuck nut *D*. On the forward stroke of the piston *A* the rifle bushing *C* is rotated in the direction shown by the arrow at section *XX*. On the back stroke of the piston the rotation pawls are held in engagement between the serrations *C*-1 of the rifle bushing *C* and the tapered side *B*-1 of the rotation bushing *B*, as previously described. The rotation bushing *B* is prevented from turning, so the rotative action caused by the spiral grooves *A*-1 sliding over the spiral teeth *C*-2 of the rifle bushing *C* will cause the piston to turn in the cylinder. This rotating action of the piston will cause the chuck sleeve *E* to be rotated by means of the straight grooves *A*-2, which engage the straight teeth *D*-1 of the chuck nut *D*, which is screwed tightly into the chuck sleeve *E*.

The chuck sleeve *E* is provided with driving lugs *E*-1, which engage the lugs on the shank of the drill steel, which is of the form shown in Fig. 2. By this means the rotative movement is conveyed to the drill steel. The chuck key *F* is so designed that the same can be turned after the drill steel has been placed in the operating position in the chuck. This will prevent the drill steel from becoming disengaged during the operation of the machine.

A modification of the rotation mechanism just described is shown in Fig. 10. The operation of this mechanism is identical with the one shown in Fig. 9, with the exception of such parts as are necessary to prevent the rifle bushing *B* from turning in a clockwise direction.

Referring to Fig. 10, it will be seen that the rifle bushing *B* is free to turn in the direction indicated by the arrow, but is prevented from turning in a clockwise direction by the rotation pawls *C*, which are held in place in the teeth *A*-1 of the rotation ratchet *A* by means of the pawl plungers *D* and the tension of the springs *E*.

As before stated, the action of this rotation is the same as that shown in Fig. 9—that is, the rifle bushing *B* is turned by the action of the spiral grooves *F*-1 in the piston *F* sliding over the spiral teeth *B*-1 in the rifle bushing *B*. When the rifle bushing *B* is prevented from turning in a clockwise direction by the engagement of the pawls *C*, the rotative movement of the piston is conveyed to the chuck parts by means of the straight grooves *F*-2 in the piston *F* sliding over straight teeth in the chuck nut, which is screwed tightly into the chuck sleeve. The chuck sleeve is provided with proper bushing to fit the shank of the drill steel. Any rotative movement of the piston is accompanied by a like movement of the chuck and drill steel.

Independent Rotations

It is claimed by some designers of rock drills that if the drag placed on the piston by the work of rotating the drill steel is removed, the drilling speed of the machine will be increased approximately 20 per cent. It is an undisputed fact that greater drilling speed is acquired if some method of rotating the drill steel by means other than that of the piston, as has been previously described, is used.

Considerable investigation has been made regarding the various means by which the drill steel may be rotated by a device independent of the piston, the object in view being the design of a rock drill in which the piston is free to deliver the blow upon the steel without the retardation caused by the drag of the rotation mechanism.

Independent Rotation Mechanism for Hammer Drills—Motor Driven

A rock drill having this feature is shown in Fig. 11. The rotation of the drill steel is obtained by means of a motor operated by compressed air. This motor is made on the principle of the Boardman rotary engine, and the necessary gears, shafts, and other parts to convey the rotary action of the motor to the drill steel is provided.

Air under pressure is admitted through the inlet *C* and is applied to the pressure vanes *D*. This causes the rotor *B* to turn in the direction indicated by the arrow. These pressure vanes are held against the periphery of

the motor chamber *A* by means of the springs *E;* one end of it is held in the rotor *B*, the other end being attached to the pressure vane. By means of a radial tension on the spring the pressure vane is at all times held in contact with the wall of the motor chamber as shown.

After the air has driven the rotor *B* to a position in which the port *F* will be opened, the air passes through the port *F*-1 to the valve of the drill; the exhaust air from the rotation motor is thus used to operate the piston of the machine, after which it passes to the atmosphere through the exhaust *L*.

The motor is designed so the rotor *B* is eccentric with the bore of the motor chamber *A*. This permits the minimum of back pressure against the pressure vanes *D*. Provision is made in the design of the rotor to provide clearance for the pressure vanes when they are passing the point of contact between rotor *B* and the motor chamber *A*.

The rotary movement of the rotor *B* is conveyed to the chuck sleeve *K* by means of the worm *G*, which meshes with the worm gear *I*. The worm gear *I* is fastened to the shaft *H*, which is provided with the pinion *J* on the front end. The pinion *J* meshes with the gear teeth *K*-1, which are cut in the chuck sleeve *K*. It follows that any rotative movement of the rotor *B* will be conveyed to the chuck in the manner just described. The chuck *K* is machined to receive the shank of the drill steel *S* which will be rotated.

The rotation speed of the drill steel depends upon the speed of the rotor *B* and the ratio of the gearing. In the mechanism just described there is a combined ratio between the speed of the rotor *B* and the chuck sleeve *K* of approximately 13 to 1; that is, the rotor *B* makes thirteen revolutions for each revolution of the chuck sleeve *K*.

Provision for oiling the machine has been made. The oil is placed in the oil chamber shown. The oil will then gradually work through the packing placed in the oil holes and find its way to the moving parts of the machine.

Another type of independent rotation mechanism is shown in Fig. 12. This consists of a reciprocating piston *C*, which is controlled by the valve *A*. The reciprocating movement of the piston *C* causes an oscillating movement of the ring *K*; the chuck *M* is rotated

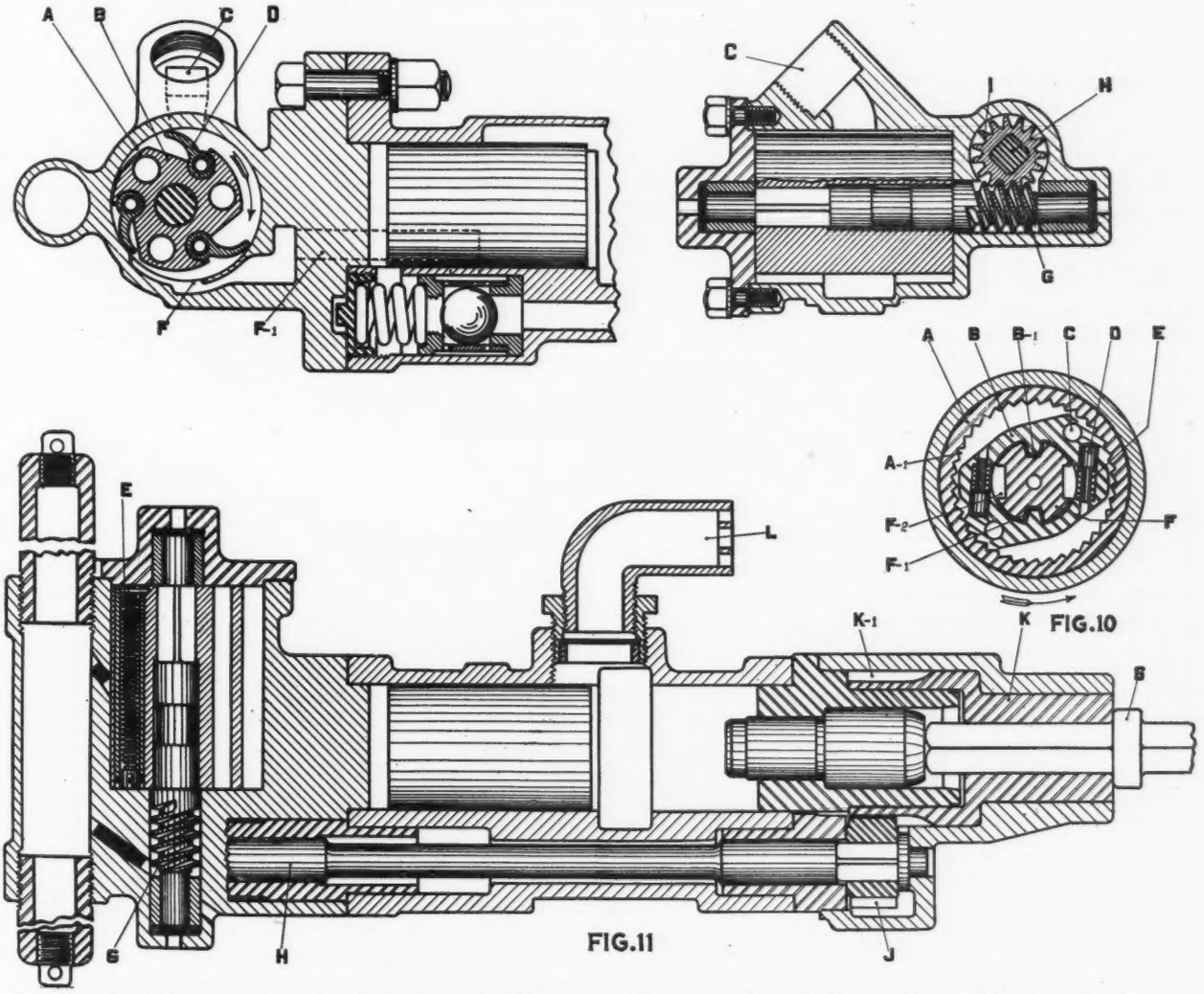


Fig. 10—Modification of mechanism shown in Fig. 9. *Fig. 11—Independent rotation mechanism for hammer drills—motor driven*

by means of the pawls *L*, which are gripped by the wedging action of the face *K*-2 of the oscillating ring *K* and the chuck *M*. This rotative movement of the chuck *M* takes place when the oscillating ring *K* is turned in a counter-clockwise direction as indicated by the arrow *X*. When the oscillating ring *K* is turned in a clockwise

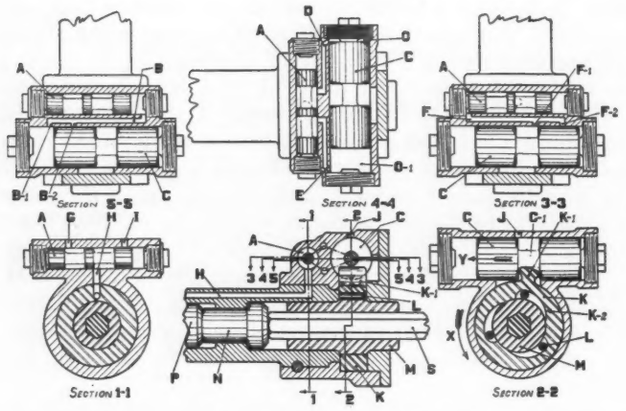


Fig. 12—Independent rotation mechanism for hammer drills—operated by independent piston

direction the pawls *L* are released and there will be no rotative movement of the chuck *M*.

The oscillating movement of the ring *K* is obtained by means of the extension *K*-1 of the oscillating ring *K* which fits into the annular space *C*-1 which is formed by reducing the diameter of the piston *C* at this point.

As shown in Fig. 12, fluid under pressure is admitted to the valve chamber by means of the port *H*. This fluid will pass through port *D* to the space shown at *O*. The piston *C* will be driven in the direction indicated by the arrow *Y*, the space *O*-1 being connected with the atmosphere by means of the ports *E* and *G*. As previously described, this movement of the piston *C* will cause an oscillating movement of the ring *K*, and the wedging action of the pawls *L* will result in a rotative movement of the chuck *M*, which will cause the drill steel *S* to be rotated.

As the piston travels in the direction indicated by the arrow *Y*, the port *F*-1 will be closed and the port *B*-2 opened to the atmosphere through port *J*; the port *F*-2 will be opened by the travel of the piston *C*, which will permit fluid to pass through port *F*. This will cause the valve *A* to be thrown to a position opposite to that shown. Space *O* will then be connected to the atmosphere by means of the ports *D* and *I*. Fluid will then be admitted to the space *O*-1 through port *E*. This will cause the piston *C* to be driven in a direction opposite to that indicated by the arrow *Y*, which will in turn oscillate the ring *K* in a clockwise direction; but, as previously described, no rotative movement of the chuck *M* will take place, due to the release of the pawls *L*.

When the piston *C* travels in the direction counter to the arrow *Y*, the port *B*-2 will be closed and the port *F*-1 will be opened to the atmosphere through port *J*. Fluid will be admitted to the valve chamber through ports *B*-1 and *B*. By this means the valve *A* will again be moved to the position shown in Fig. 12, thus admitting fluid through port *D* to the chamber *O*, thereby causing the piston *C* to again be driven in the direction indicated by the arrow *Y*. The cycle of operations as described is continuous, the chuck *M* being given a rotative movement on each stroke of the piston *C*, when same is driven in the direction indicated by the arrow *Y*.

By the use of this rotation, all drag is removed from the piston *P*, which is free to deliver the full force of the blow upon the anvil block *N*, by which means the force of the blow is conveyed to the drill steel *S*.

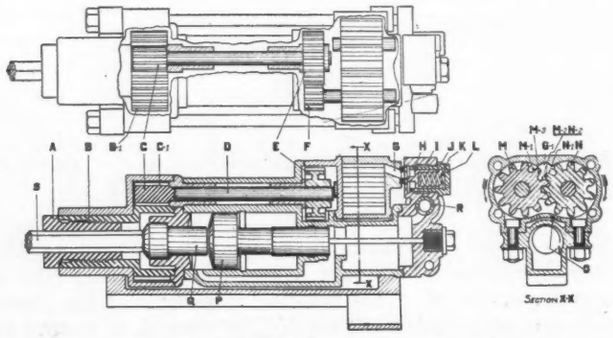


Fig. 13—Independent rotation mechanism for hammer drills—operated by gear-type motor

Independent Rotation Mechanism for Hammer Drills—Operated by Gear-Type Motor

A departure from the designs of independent rotations just described is shown in Fig. 13. The rotative movement is secured by means of a motor which consists of a pair of well-machined gears running in mesh. A better idea of the operation of this motor will be obtained by reference to section *X-X*, Fig. 13, which shows the gears in mesh. Fluid under pressure is admitted to the supply space *G*-1 through the port *G*.

By examination of the teeth of the gears that are exposed to the pressure of the fluid, it will be found that the surfaces *M*-1, *N*-1, *M*-2, and *N*-2 are in balance—that is, the pressure upon the face of the gear teeth which would tend to turn the gears is such that the gears are held in equilibrium. It is found, however, that the face of the tooth *M*-3 is exposed to the pressure without any balancing surface on either gear. This will cause the gears to rotate in the direction indicated by the arrows. The motive fluid will pass around with the gear and exhaust to the atmosphere through ports *O*. In motors of this type the surface area of one tooth is at all times exposed to pressure, which drives the gears in the direction indicated. The exposed tooth area alternates from gear *M* to gear *N*.

The rotative action of the motor is conveyed to the drill steel *S*, by means of a system of gears and shafts. The pinion *F* which is attached to the gear *M* drives the gear *E*, which rotates the shaft *D*. The pinion *C* is formed on the shaft *D*. The gear teeth *C*-1 of the pinion *C* mesh with the teeth *B*-1 of the chuck sleeve *B*. The chuck *A* is screwed tightly into the chuck sleeve *B*. The chuck *A* is machined to the proper size and form to fit the shank of the drill steel *S*. It will be seen from the above that any rotative movement of the motor gear *M* will be conveyed by means of the gears *F* and *E* to the shaft *D* and the gear *C* to the chuck sleeve *B*, which by means of the chuck *A* will rotate the drill steel *S*.

The motive fluid under pressure is supplied to the annular space *I* by means of the throttle valve *R*. Through a port (not shown) it then enters the supply space *G*-1 by means of the ports *H* and *G*. The governor valve *J* is so arranged that if the motor is slowed down by any cause the pressure will be built up (due to the reduced amount of fluid passing to the exhaust) in the supply space *G*-1. This will force the governor valve *J* back against the pressure of the spring *K*, thereby uncovering more of the port *H* which will permit a greater amount of motive fluid to enter the supply space *G*-1, for the purpose of overcoming any overload on the motor.

Under normal working conditions the governor valve *J* is held in position by the tension of the spring *K*, the location of the valve being such that the correct amount

of motive fluid is allowed to pass through the port *H* to insure proper working of the motor. Ports *L* allow any leakage past the valve *J* to pass to the atmosphere, thereby avoiding any back pressure against the governor valve *J*.

It will be seen that by the use of the rotation just described the piston *P* is free to deliver the full force of the blow against the anvil block *Q*, by which means the force of the blow is conveyed to the drill steel *S*.

In Fig. 14 is shown a modification of the rotation mechanism just described. Though the principle of this mechanism is similar to the one described above, there are some changes in the details of construction. These consist mainly in the location of the motor and the means of control as shown in Fig. 14.

The operation of this mechanism is as follows: Motive fluid under pressure is admitted to the supply chamber *G*-2 by means of the throttle valve *H* and the ports *G* and *G*-1. This motive fluid will drive the motor gears *J* and *K* in the direction indicated by the arrows. The theory of operation of this type of motor has been previously described. The motive fluid passes around with the motor gears and exhausts through the port *F*, after which it passes through the port *I*-1 and exhausts to the atmosphere through the port *I*.

The pinion *D* is fastened rigidly to the shaft of the motor gear *K*, and any rotative movement of the gear *K* is accompanied by a like movement of the pinion *D*. The teeth of the pinion *D* mesh with the teeth of the gear *C*, to which is attached the pinion *B*. The teeth of the pinion *B* mesh with the teeth *A*-1 which are cut in the chuck sleeve *A*.

It follows that any rotative movement of the motor gear *K* will be conveyed to the chuck sleeve *A* by means of the pinions *B* and *D* and the gear *C*. The chuck *E* is provided with driving lugs which engage the driving lugs *S*-1 of the drill steel *S*. By this means any rotative movement of the chuck sleeve *A* is imparted to the drill steel *S*.

Rotation of the Stoper-Type Drill

The stoper type drill is used to advantage when drilling holes that incline from approximately 20 deg. above the horizontal to vertical. The characteristic features of this machine are more or less common to all of the standard makes that are on the market.

These features consist of a drill of the hammer type which is provided with a telescoping air-feed arrangement, which holds the drill bit in position against the rock. An outline sketch of the stoper drill is shown in Fig. 15.

Practically all of the drills of the stoper type that have been placed upon the market to date are of the hand or manually rotated type; that is, the machine is rotated by the operator, who takes hold of the handle shown at *A* and by giving it an oscillating movement transfers to the drill steel *S* the required rotative action.

Considerable progress has been made in the design of an automatic rotated stoper drill, some of which have probably been sent to various mines for test purposes. When a machine of this type is finally standardized with the automatic rotation feature it will probably be provided with one of the standard rotations that have been previously described, the type depending upon the manufacturer of the machine, although it may be necessary to make some slight modifications in construction to make the mechanism adaptable to this type of drill.

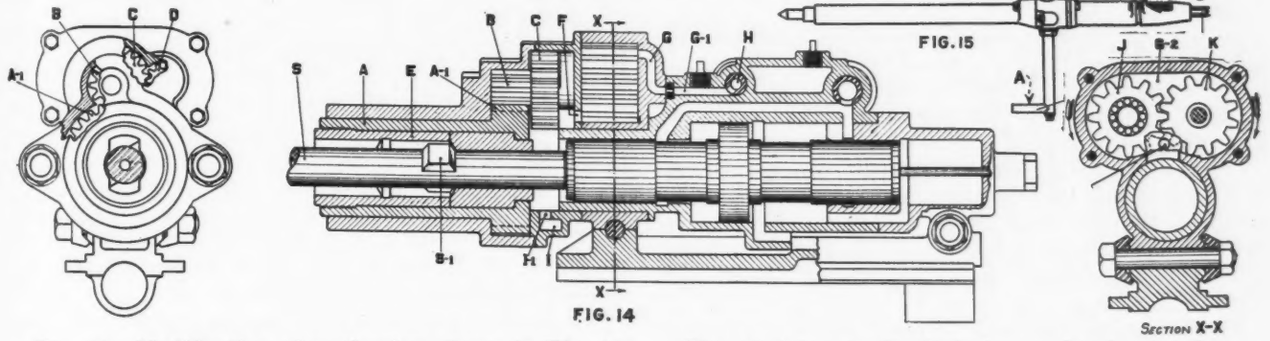


Fig. 14—Modification of mechanism shown in Fig. 13

Fig. 15 (above)—Typical stoper—hand rotated

Sales of Crude Feldspar in the United States Increased in 1922

Reports made by producers of crude feldspar in the United States in 1922 to the Geological Survey show sales amounting to 114,200 long tons, valued at $812,400, an increase of 24 per cent in quantity over the sales in 1921. The average price was $7.11 a long ton. In Maine feldspar averaged $10.06 a long ton, in New Hampshire $8.33, and in North Carolina $5.77.

Crude Feldspar Sold in the United States in 1921 and 1922

	1921		1922(a)	
	Long Tons	Value (b)	Long Tons	Value (b)
California and Colorado	2,057	$15,847	2,500	$17,500
Connecticut	9,565	65,864	7,600	48,200
Maine	18,866	134,168	23,100	232,400
Maryland	5,155	33,798	2,900	18,100
New Hampshire	(c)	(c)	14,000	116,600
New York	(c)	(c)	(d) 12,500	(d) 81,900
North Carolina	40,712	259,603	51,600	297,700
Pennsylvania	(c)	(c)	(c)	(c)
Undistributed	15,510	108,372	.....	.....
Total	91,865	$617,652	114,200	$812,400

(a) Figures for 1922 are preliminary and subject to revision.
(b) Value at mine or nearest shipping point.
(c) In 1921 included under "Undistributed." In 1922 included in New York.
(d) Includes a small production from Pennsylvania.

Phosphate Rock Shipped in the United States in 1922

According to the Geological Survey, 2,417,883 tons of phosphate rock, valued at $10,828,346, was shipped from mines in the United States during 1922. Florida, the leading state, shipped 2,058,593 tons, worth $8,347,522, more than nine-tenths of which was land-pebble phosphate. From Tennessee, 353,309 tons, worth $2,107,382, was reported, including a comparatively small quantity from Kentucky, most of which was brown rock. Small shipments were reported from Idaho and South Carolina.

USEFUL OPERATING IDEAS

Rapid Erection of Five-Piece Arch Sets in Pump Chambers

BY ALBERT I. LONG

A CONTRACT was recently made by the New Cornelia Copper Co., Ajo, Ariz., for shaft sinking and accessory workings in connection with the development of a water supply for the new concentrator which is now under construction. The contract included the sinking of a two-compartment shaft, 650 ft. deep; the driving of a connecting tunnel, 14x12 ft. (inside dimension, 12x12 in. timbers) and 132 ft. long to another shaft, and the construction of four pump chambers, each 19 ft. wide by 14 ft. high and 50 ft. long (inside dimensions, 12x12 in. timbering), and a sump 16x16x80 ft. above the pump chambers. The sump was not timbered; the connecting tunnel sets were square sets, and presented no unusual difficulties, but the pump chamber sets were five-piece arch sets with posts 8 ft. 5 in. long, on the long cut, angle caps 7 ft. 8 in. long, and the main caps 13 ft. 3 in. long, each weighing about 550 lb. The back end of the station was to be lagged with 3x12 in. long lagging. The sets were 6 ft. apart and lagged all around, and were nailed where possible, and keyboards were placed on all lagging and blocked.

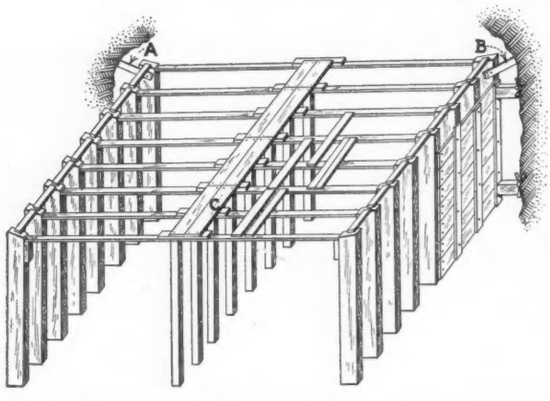


Fig. 1—Pump chamber with sills, posts, lagging and blocking in position and lower staging started

I was familiar with the common methods used in mines for standing arch sets, but had long been of the opinion that existing methods could be materially improved, resulting in advantage to the company by reducing time and costs, and at the same time facilitating the work of the timbermen by making the lifting easier, as this kind of timbering generally requires much heavy backwork. Having several weeks to plan the details before this part of the work started, I finally evolved a method for the erection of the sets, which, on being presented to the contractor for whom I was working, met with his approval.

When the time came to timber the pump stations I first placed the sills in position. An old piece of 3x12-in. lumber or two pieces of regular lagging were nailed on the posts at the top, three inches below the short cut, or the inside dimension of the post, as shown at *A*, *B*, Fig. 1. The posts were then stood in their respective daps on the sills and toenailed with 60-d. spikes. All of the posts having been placed in position, two men on each side of the station placed the collar braces between the posts in the 1-in. daps that had been cut to receive them and then plumbed the sets lengthwise with the station. The posts on one side were then plumbed for crosswise with the station, and a piece of lagging was nailed on the side of post as a temporary block. The spreaders, 18 ft. 11 in. in length, were then placed on top of the 4x12-in. cleats nailed on the posts as shown in Fig. 2. The posts on the other side of the pump chamber were then plumbed and two wedges were placed between each spreader and post to facilitate the removal of the spreader after tightly blocking the posts and when through with the staging. The posts were then kept in position by pieces of lagging nailed to the post and bearing against the ground as at *A*, *B*, Fig. 1. Auxiliary posts, 6x6 in. in size, were then placed under the long spreaders, and ¾-in. bolts, countersunk in the spreader, were dropped into place. The auxiliary posts were placed 6 in. out of center so that if it were necessary to return the center lines, this could be done without interference. Lagging 2x12 in. by 12 ft., was then nailed on the top of the short pieces, 4x12x36 in., placed on the top of the spreaders as shown at *C*, Fig. 1, and the whole structure was thus stiffened. Both sides of the pump chamber were then lagged, the lagging being nailed where possible and keyboards being placed vertically behind each post at the junction of the lagging. The keyboards were blocked at top and bottom. The top blocking was put in place from the top of the staging. The posts were now all in correct position and blocked and lagged as shown in Fig. 1. Old 2x12-in. by 12-ft. boards that had been used for various purposes while cutting the stations were then laid upon the spreaders to form a staging from which to work. Two 3½-ft. saw horses were next placed at the end of the first set and long lagging laid upon them to form a staging. Two short 2x4-in. pieces were laid crosswise on the staging, so that the caps would rest on them and allow room for the miners to get their fingers under the caps to lift. The first cap was sent up and rolled to the far end of the station, and the two angle caps were next passed up, each piece being placed at the first handling in as near as possible the position where it was to be used. The remaining pieces of staging were then sent up, together with blocks, wedges and other pieces, and the whole crew was transferred to the staging.

Two men on each side of the station stood the angle caps, placed the 6x6-in. braces (No. 5, 6, Fig. 2) in position and then dropped the spreader (No. 8, Fig. 2) into position. The collar braces were then placed in their daps and nailed, the lower collar braces preventing

the slipping of the bottom of the angle caps. The distance between top edges of the long caps was then carefully measured and the position of the angle caps was made to coincide exactly with the dimensions. As a result, none of the long caps had to be lifted twice. The angle caps were held in position by short pieces of lagging nailed to the sides of the angle cap and bearing against the ground, as shown in the upper part of Fig. 2.

One end of the long cap was now raised as at 1, Fig. 2, and a lagging board slipped under it, the lagging board resting on the center upper spreaders. A wedge was placed on the lagging, and the other end of the cap was lifted and a lagging board and wedge slipped under it. The wedges served a twofold purpose. Other lagging boards could be slipped under the cap without another lift, and thus the staging could be completed and the two wedges provided a handhold for the next lift. All four men took to the top staging and easily made the last lift of three feet, landing the cap in position. From the top staging the men lagged and blocked the long cap in place. As each set was completed the top staging was taken down and put out of the way. As no nails were used in the staging, it could be used and removed as necessary without injury.

Four men took the timber from the timber yard at the collar of the shaft, lowered it 650 ft. down the shaft, trammed it through a 100-ft. connection, erected it and left the pump chamber complete and clean in two shifts and six hours, or 88 man-hours in all. I did no actual work in the erection. The sills were already laid and the staging timber was already down at the station.

Four pump chambers were timbered by the system and the time given was the best record made. As the best estimated time for the same number of men by customary methods is one set per shift lagged and blocked, I believe that the method developed is more efficient than the ordinary procedure and eliminates the heavy lifting usually necessary in erecting arch sets.

Moving Roll Cores and Shells

By Roy H. Poston

Apparatus for moving heavy roll shells and cores about a plant with facility has been devised by a southeast Missouri lead company. A wagon tongue was attached to the discarded front truck of a diamond-drill boiler. Two short pieces of 65-lb. rail were bent about 30 deg. at each end for about one-quarter of their length. These pieces were attached at one end to the truck axle with a 1½-in. bolt, one piece on the right and the other on the left just inside the wheels, the free ends trailing on the ground. When cores are to be moved they are placed between the rails, which slope from the truck shaft to the ground, and each end of the core axle is attached to the truck by means of a suitable length of flexible wire rope. Care should be taken to have the two pieces of rope of the same length. On level ground or going uphill the core moves readily along between the rails or guides. Going down hill the core will run up on the sloping rails, thus serving as a brake. When moving shells without the cores a piece of timber such as a railroad tie may be run through the shell and attached to the truck in the manner stated.

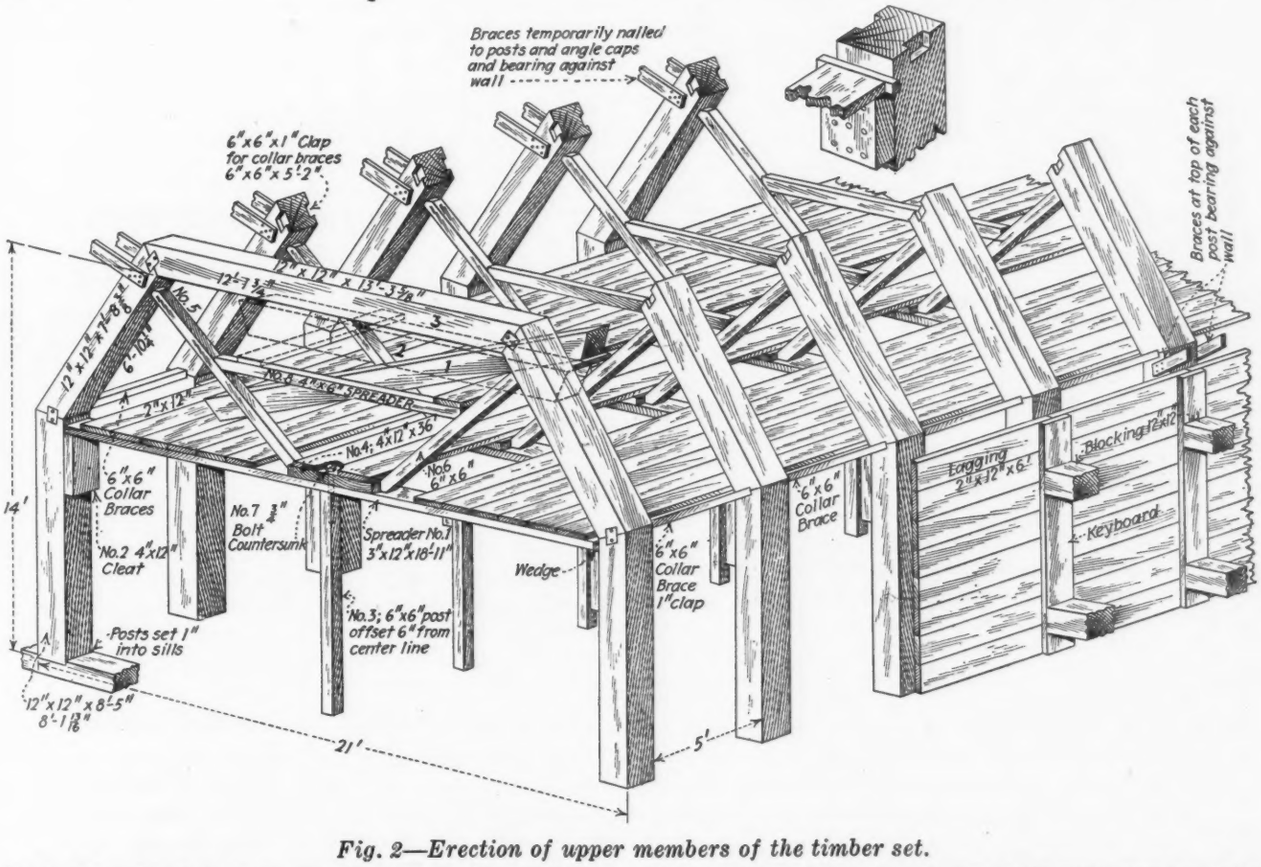


Fig. 2—Erection of upper members of the timber set.

No. 1, 3x12 in. by 18 ft., 11 in. cut 1 in. short so that wedges can be inserted at one end to facilitate dismantling. No. 2, 3x12 in., or 4x12 in., odd pieces spiked to posts at given height to support the spreader No. 1. No. 3, 6x6-in. post with 1-in. hole in upper end to receive a ¾-in. bolt to prevent slipping sideways. No. 4 4x12x36 in. spiked to spreader as foot block for Nos. 5, 6. Nos. 5, 6, 6x6-in. posts to support angle caps while main caps are being placed. No. 7, ¾-in. iron bolt in countersunk hole entering the auxiliary posts. No. 8, 4x6-in. spreader to brace No. 5, 6 and to support upper staging when raising main caps. 1 shows first position of cap; 2 (dotted outline) shows the position on upper staging and 3 in place.

THE PETROLEUM INDUSTRY

Large Income from Osage Leases

Production of oil and gas on Osage Indian lands in northern Oklahoma has reached proportions of such magnitude as to outrival records made by any oil and gas fields at any time in the history of the world, says the Secretary of the Interior, as a result of a complete compilation of the oil leases, including bonuses and royalties, made by the government for the Osage Indians.

From 1905, when oil was first discovered, up to March, 1923, approximately 212,000,000 bbl. of oil have been taken from the Osage reservation. There have been drilled 8,360 oil wells. Every one of them are producers with the exception of five dry holes, the smallest proportion ever known in oil and gas drilling operations. Leases have been made to the number of 3,300, each lease covering oil and gas rights on 160 acres. The rate of production of oil at the present time is 3,200,000 bbl. a month, and the royalties have aggregated $1,000,000 per month between 1915 and 1923, all of which is paid to the Secretary of the Interior and distributed to the 2,229 Osage Indians and their heirs.

The total income accruing to the Osages both from cash bonus and from royalties since this rich field of oil and gas was found eighteen years ago reached the huge figure on May 1, 1923, of $136,014,397. In the month of April alone receipts from bonuses and royalties amounted to $6,069,000, with indications that these would be exceeded during the present month. In addition to the millions of dollars distributed to the Osage Indians in previous years, the members of this tribe in 1922 received $26,079,300 from their bonuses and royalties, which gave each man, woman, and child $11,700.

The total area of the Osage reservation is 1,500,000 acres, and leases for gas and oil have been made separately. Up to this time 550,000 acres have been found to contain oil. The Burbank Oil section has proved the richest, where as high as $1,600,000 cash bonus has been made for a single lease on a single tract of 160 acres, with a royalty of one-sixth of all oil or gas produced to be returned to the Indian. Ninety-six different oil companies now hold leases in this field.

Production of oil and gas has become so huge and the leasing situation so complicated that it has become necessary for the Secretary of the Interior to supervise the enforcement of the terms of the leases and to check up on the flow of oil and gas from the various wells so as to collect all royalties due the Indians through a regular organization of government employees. Rigid regulations have been drawn up and endorsed by the oil operators, the violation of which result in the payment of fines. Already the aggregate sum of $10,000 has been collected in fines, but this system has resulted in making the Osage oil and gas fields the best regulated in the country.

Future production of the Osage reservation is inestimable. When the oil and gas supply will be exhausted is a matter that even the keenest oil operators of the United States will not hazard a prophecy.

Many Permits Issued for Drilling in Alaska

Oil companies and private individuals to the number of 743 have permits to drill for oil in the Alaskan Territory, according to the Department of the Interior. In all 1,175 applications for permits to develop oil fields in Alaska have been filed with the government, 1,056 being presented at the Juneau land office, 119 at the Nome land office, and 20 at the Fairbanks land office. Favorable action has been taken on only 743, with final rejection of 95 and the remainder being held up pending investigation and survey.

In only a few instances has the Interior Department received notice that drilling operations have been started. A number of surveys have been completed of prospective oil fields in Alaska, including the Cold Bay district, Alaska Peninsula, the Aniakschak, and the Yakataga regions. Up to this time 100 applications for extension of time to begin drilling for oil have been received and granted by the department.

The total number of acres that have been leased for oil exploitation in the territory is estimated at 2,994,000 acres, two-thirds of which are located on the Alaska Peninsula in the Cold Bay and Aniakschak regions, the remainder being scattered over the Katalla, Yakataga, Iliamna, Kootsnahoo, Seward, Wasilla, Anchorage, Lituya Bay, Young Bay, and Kachemak Bay, Inniskin, and Point Barrow regions.

An immense area in the northern part of the Nome land district was recently set aside as a petroleum reserve for the Navy.

New Well on Teapot Dome Reserve

An oil well with an estimated production of 4,000 bbl. per day was recently brought in on the Teapot Dome Naval Oil Reserve, in Wyoming, in the section where a detachment of United States Marines were used last year to stop trespassing. The well was brought in on May 13 and allowed to flow uncontrolled for seven hours, during which time connections were installed. It is near the "trespass well," given that name because the Mutual Oil Co. started drilling it and operations were not stopped until marines were sent to the scene.

A lawsuit between the Mutual Oil Co. and the Sinclair interests is now in progress over the lease to this particular district, with result that the oil produced will be impounded from sale. The government, according to the arrangement, will receive temporary receipts covering its share of royalty oil produced by the new well.

New Well in Southern Alberta

The Imperial Oil Co. has discovered oil in a new section, near Coutts, southern Alberta, where it obtained two barrels of good oil, but at the same time encountered sulphur water, which blocked the flow of oil. An attempt is being made to cement in the water. Whether it is successful or not, the discovery is considered important as proving the extension of the Montana Sweet-Grass field north of the border.

New Books

Among the books recently received for review are "Metallography and Macrography," by Guillet and Portevin, translated by Taverner; "Filtration," by Bryden and Dickey; "Briquetting," by Stillman; "Principles of Chemical Engineering," by Walker, Lewis, and McAdams; "Metals and Their Alloys," by Vickers; "Motor Fuels," their production and technology, by Leslie; "Low Temperature Carbonization of Bituminous Coal," by McCulloch and Simpkin; and "A Tested Method of Laboratory Organization," by Pile and Johnston, the last two being British books. Then there are two books in German: A new Hütte—"Taschenbuch für Eisenhüttenleute," second edition; and "Studien über die Kupfererzeugung der Welt," by Hochschild. We hope to review these books at not too distant a date. We have also received the year books of the American Institute of Electrical Engineers, and of the American Institute of Mining and Metallurgical Engineers, containing revised membership lists.

In the list given in the preceding paragraph, we did not mention a new English book on ore dressing just published by Macmillan, written by Professor Truscott. We are reviewing this ourselves, reading every word of it, so it may be some time yet before our review will appear. In the meantime, we can safely say that it is the best book on ore dressing now available. Though an English book, American practice does not seem to be overlooked, and in the first hundred pages the only adjustment the American reader will have to make will be to change English money to dollars and cents, and to put the Utah Copper Co.'s mine in Utah instead of in Arizona, where the author has it, and in bold type too. Though the Idaho-Maryland Mines Co. is in California, the Utah Copper Co. holds to the state for which the company is named.

In the June *Atlantic Monthly* is an article entitled "Copper: A Study in Ingots and Men." It is by Charles Rumford Walker, author of "Steel: The Diary of a Furnace-Worker," published serially last year by the *Atlantic* and later issued in book form. Mr. Walker worked as a common laborer in the steel mills, and later, as a basis for the present article, "in one of the largest copper and brass mills of this country he worked on refining furnaces and in the rolling-mills as an unskilled and semi-skilled workman." His narrative indicates that the methods obtaining at the plant wherein he worked were not very up to date and quite different from the way things are done at the large copper refineries which we know of. We are glad that our responsibility for the technologic progress of the industry does not extend to the brass mills. We thought first that conditions in an ordinary electrolytic refinery were being described, until Mr. Walker began talking about two-hundred pound ingots, and describing the different kinds of scrap that he unloaded and charged to the furnaces. "It was more fun unloading automobile gaskets than plain bundles of rectangular strips," he says, but we gather that there was not much fun in any of it. We quote a part of the final paragraph:

"A common-labor floor gang is the lowest rung in the ladder, I suppose. Its security is at a minimum, and it will feel the unemployment hatchet first. (Five of us were dropped last pay day.) And the job itself is crude and unalloyed labor. It is not true to say that no apprenticeship is needed. There is a knack in handling sledge, chain, shovel, bar, that is not learned in one shift. But of craftsmanship, of real skill, there is a hint and no more. The "dirty work" of society falls to the labor gang. They are at the frontier—which machinery and intelligence hasn't reached: the inheritors of the work of the pyramid builders and of the men who lifted up the stones for the Chinese wall."

Coal and Coke Analysis

Sampling and Analysis of Coal, Coke and Byproducts. Carnegie Steel Co., Pittsburgh, Pa. Price, $3.

Of the methods commonly employed in the evaluation of coal and coke, many are purely empirical and, therefore, subject to such variation in technique that very widely differing results may often be obtained by different operators working on the same sample. From time to time, attempts have been made to standardize these methods so that results obtained in any laboratory might be comparable with those obtained in any other. The present volume is such an effort.

Compiled by the chief chemists of the several units of the U. S. Steel Corporation, the book is the work of a body of men well qualified to approach the task. Appearing first as a small pamphlet, the present edition of the book appears as an attractively bound volume of about 180 pages. The original pamphlet has been revised and rewritten, and much new matter has been added to bring the work up to date. This revision has been deemed advisable, in view of the rapid progress in the byproduct coke industry in recent years.

Among the new features of the book, one which particularly commends itself is the addition of a series of physical tests of coal and coke. These tests should prove of great value in determining the relative value of different samples of coal or coke under the special conditions to which they may be subjected. The book is a valuable contribution to the efforts toward standardization of the methods for coal and coke analysis.

R. M. Coleman.

Recent Patents

Zircon Extraction — No. 1,451,004. April 10, 1923. L. E. Barton and C. J. Kinzie, Niagara Falls, N. Y., assignors to The Titanium Alloy Mfg. Co., Inc., Niagara Falls, N. Y. Ores containing zircon are mixed with an alkali-metal bisulphate, the mixture heated, and the resultant product leached, thereby separating the undesired substances from the zircon residuum.

Amalgamator—No. 1,451,097. April 10, 1923. W. C. McLaughlin, Oakland, Calif. A gold-saving device made up of several superimposed communicating drums, each equipped with several concentric screens.

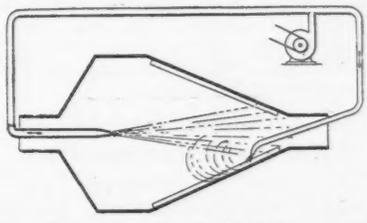
Zinc Smelting—No. 1,451,176. April 10, 1923. J. E. Pederson, Hillsboro, Ill., assignor to American Zinc, Lead & Smelting Co., St. Louis, Mo. A machine for throwing material into zinc retorts.

Gold Panning Machine—No. 1,451,567. April 10, 1923. C. E. Erickson, Delta, Utah, and M. J. Mast, Grand Junction, Colo. A bumping table carrying a pan with an amalgamated corrugated copper bottom.

Copper Leaching — No. 1,451,734. April 17, 1923. Joseph Irving, Bisbee, Ariz. In copper-ore leaching, the leaching power of a sulphuric acid-ferric sulphate liquor is increased by bringing it in contact with pyritic material.

Cone Thickener—No. 1,452,016. April 17, 1923. Charles Allen, El Paso, Tex. A slime-pulp thickener with a float adapted to discharging the thickened mass as soon as it has reached a certain density.

Ball-Mill Discharge — No. 1,450,289. April 3, 1923. H. W. Hardinge, New York City. Means for aiding the classifying action and the discharge from a Hardinge mill, as shown in the illustration. In patent No. 1,450,290, means is provided for returning the oversize discharged from a Hardinge mill, by attaching a supplementary cone to the discharge trunnion, and returning the oversize material, collecting in this cone, through a pipe back into the mill.



Ore Classifier—No. 1,450,118. March 27, 1923. H. A. Smith and H. H. Brown, Oakland, Calif. A tank, with mechanically driven paddles, and a central tube for the discharge, adapted to concentrate or classify ore.

Pulverizing Mill—No. 1,452,218. April 17, 1923. R. E. H. Pomeroy, Canton, Ohio. A pulverizing mill equipped with a special type of head for distributing the material ground.

SOCIETIES, ADDRESSES, AND REPORTS

Official Ignorance of Mining Industry Inexcusable

Senator Pittman Cites Effect in Recent Silver Controversy—Mathewson Speaks

E. P. Mathewson, president of the American Institute of Mining and Metallurgical Engineers, appealed, during the course of an address before the Washington Section of the Institute, for co-operation on the part of the mining industry in general with the Senate Commission of Gold and Silver Inquiry. Senator Oddie, of Nevada, the chairman of the commission, also is president of the Washington section. He pointed out the possibilities which the authorization of the commission offers in service to the producers of gold and silver and to the mining industry and the public in general.

Senator Pittman, in the course of remarks at the meeting, declared that official ignorance of the mining industry contributes importantly to many of its difficulties. He characterized this as inexcusable, since the government has within its own organization specialists in all the ramifications of the industry who are entirely competent to advise, but whose opinion frequently is not asked. He cited as an example the latest instance in which an under secretary of the Treasury had undertaken to make a saving for the government at the expense of breach of contract and breach of faith with the silver producers. On that occasion, Senator Pittman also announced that producers of silver in all countries of North and South America would be invited to the great silver meeting which is to be held at Reno, Nev., this summer.

Seven Universities Adopt Co-operative Fellowship Plan

During the next school year, the following universities will offer graduate fellowships in mining, metallurgical, and chemical research, in co-operation with the Bureau of Mines: University of Alabama, University of Arizona, Carnegie Institute of Technology, University of Missouri, Ohio State University, University of Utah, and University of Washington.

This plan of fellowships first was effected through a co-operative agreement between the Bureau of Mines and University of Utah in 1914. The results have been highly successful throughout that period. The fellowships are awarded graduates of colleges, preferably of mining schools, who have shown special aptitude for research and investigational work.

Fatigue of Metals Being Studied at University of Illinois

Fatigue of metals has caused an estimated loss of millions of dollars annually to American industry, according to a report to Engineering Foundation and the National Research Council, by Prof. H. F. Moore, who has been conducting an investigation at the Materials Testing Laboratory in the University of Illinois. Chiefly, says Professor Moore, losses are caused not by spectacular disasters but by large numbers of minor accidents. Idle machinery is described as a principal item of cost.

During the last year the investigation of fatigue of metals has been in full progress. The main lines of work covered are: (1) The investigation of fatigue of wrought ferrous metals under cycles of stress repeated but not reversed, (2) study of the effect of heat treatment on fatigue strength of steel, (3) the obtaining of further evidence for the existence of a definite endurance limit for wrought ferrous metals, and (4) the beginning of work on non-ferrous metals.

The investigation has been financed almost entirely by the contributions of the General Electric Co. Contributions from the Allis-Chalmers Co., the Western Electric Co., and the Copper and Brass Research Association have just become available, and a study of fatigue failure of non-ferrous metals will be a major feature of the investigation in the immediate future.

Reports of the progress of this investion have been given in Bulletins 124 and 136 of the Engineering Experiment Station of the University of Illinois and in Publications 4 and 6 of Engineering Foundation.

Lake Superior Institute Will Visit Minnesota

The Lake Superior Mining Institute will hold its 1923 meeting on Aug. 29, 30 and 31. The first day will be spent in Duluth and at the plant of the Minnesota Steel Co. The second day will be devoted to an inspection of the new concentrating plant at Babbitt, on the eastern Mesaba, and some of the mines in the Virginia and Hibbing districts. On the third day a visit will be made to the Cuyuna Range, where a number of new mines have been opened since the Institute's last trip to Minnesota. An attractive program will be offered and it is believed by the committee in charge of the arrangements that the attendance at this summer's meeting will be large.

Advantages of Metric System Theme at Luncheon

Lack of Standardization Held Up as National Peril—Representatives of Industry Speak at Hotel Astor

The Metric Association met at luncheon at the Hotel Astor in New York on June 2, with about thirty members and guests present. Similar meetings were held on April 7 and March 5, the gatherings being for the purpose of keeping in touch with the progress of the metric movement throughout the world. Several scales of the platform and spring types were exhibited at the luncheon last Saturday, they being equipped with metric graduations which are proposed as standard. Also a series of gram weights were shown, made of platinum, gold, lead, aluminum, and quartz.

There were several short talks by men from representative industries that have adopted or are urging the adoption of the metric system. The chief speaker was Aubrey Drury, of the World Metric Standardization Council, San Francisco, the author of a book which was reviewed in the *Journal-Press* of July 8, 1922. Mr. Drury spoke on the world movement for the adoption of the metric system. He declared that the adoption of the metric system was one of the greatest questions before the world today, and urged that redoubled efforts be made for legislation to this effect when Congress convenes in December. The majority of Congressmen, he said, were sympathetic to the movement, and also the people as a whole, but inertia alone was delaying the adoption of the system in this country. He pointed out that Japan and Russia, with a population of over 300,000,000, have taken it up in the last two years, and that the United States and Great Britain alone of the great powers cling to the old system.

"Lack of world metric standardization is to the United States a grave national peril," said the speaker. "In world trade, in domestic trade, in education, and in preparedness for world war, there is a desperate need for standardization on the simple decimal metric units. Congress has delayed action too long. At the next session of Congress it is believed that progressive metric legislation will be enacted, providing for the gradual adoption of metric units for commercial purposes over a transition period of ten years. More than 105,000 individual petitions urging this legislation have been directed to Congress. "Thousands of organizations endorse the metric advance, including 250 member organizations of the Cham-

ber of Commerce of the United States which is expected to call a nationwide referendum on the subject. Virtually all civilized peoples are on the world metric basis, except the English-speaking peoples, who use diverse unstandardized units.

"The Industrial Significance of Standardization" was the subject of Dr. P. G. Agnew of the American Engineering Standards Committee. Doctor Agnew spoke at length on the benefits derived from standardization in various industries. In summing up its advantages in all classes of trade he said:

"One benefit of standardization is that by bringing out the need of new facts in order to determine what is best, and to secure agreement on most questions, it acts as a powerful stimulus to research and development, and is also the principal means of getting the results of research into actual use in the industries. Moreover, it helps to eliminate practices which are merely the result of accident or tradition, and which impede development.

"Finally, the joint effort in bringing about standardization within and between industries almost invariably leads to better understanding and to beneficial co-operation along other lines —a step toward the integration of our industries."

Prof. H. V. Arny, of Columbia University, said that the College of Pharmacy had, since its organization, taught and advocated the general use of metric weights and measures. This use of the metric or meter-liter-gram system saved over 40 per cent in the time and energy needed in making the average calculation.

Canadian Minerals To Be Exhibited in England

Canada is making preparations to send an exhibit representative of her mining and mineral industries to the Empire Exposition to be held in England next year. It is said that the dominion's exhibit will excel that shown at the Panama-Pacific Exposition in 1915, and $750,000 will be made available for its preparation. W. D. Dalglish, chief of the Minerals Division, Canadian Government Exhibition Commission, was in Victoria, B. C. recently, conferring with the Hon. William Sloan, Minister of Mines, as to British Columbia's representation.

Mining Congress Governors to Meet in San Francisco

The governors of the Western Division of the American Mining Congress will hold a conference in San Francisco on June 11 and 12. Afterward they will proceed to Sacramento, where a session with the Sacramento Chamber of Commerce will be held on the afternoon of June 13. The party will be divided, and one part will visit Grass Valley and Nevada City and the other part the Mother Lode on June 14, 1923. D. D. Muir, Jr., and A. G. Mackenzie will be the delegates from Utah.

Ethical Standards Proposed for Engineers

The following compilation of principles for the professional conduct of engineers has been prepared by the National Practice Committee of the American Association of Engineers:

Part I—Relations to the Public

1. The engineer should regard his duty to the public welfare as paramount to all other obligations.
2. He should not use his professional standing as a means of sponsoring or promoting speculative undertakings.
3. He should scrupulously avoid connection, by act or omission, with any illegal or questionable undertaking or participation in any enterprise inimical to the public welfare.
4. He should not advertise in self-laudatory language or in any other manner derogatory to the dignity of his profession.
5. He should avoid any publicity giving the impression that technical service in technical matters can be dispensed with; or that technical proficiency along any line is easy of acquisition; or that exaggerated returns may be expected from any limited course of technical instruction.
6. He should avoid any questionable statements or any statements couched in language that would convey a false impression.
7. When retained to report on any property or project, he should not accept as compensation any stock or other interest in the property or project, or any other contingent fee which could in any way consciously or unconsciously influence the nature of his report and its conclusions.
8. He should avoid entering into any private combination which would restrict free individual competition for professional employment. The matter of proper engineering fees and the methods of making proper tenders on engineering work should be left to professional organizations in order that their backing should inspire public confidence.
9. He should refrain from using any improper or questionable methods of soliciting professional work.
10. He should participate in clean politics and should strive to be a force to assist in the cleansing of politics.
11. He should take an active interest in the public welfare, in behalf of which he should ever stand ready to volunteer his special knowledge, skill, and training for the use and benefit of mankind.

Part II—Relations to Clients and Employers

1. The engineer should pursue his professional work in a spirit of strict fidelity and full loyalty to his clients and employers.
2. He should inform a client or employer or any business connections, interests or affiliations which might tend to influence his judgment or impair the disinterested quality of his services.
3. He should accept compensation for his services in connection with any work from one source only, except with full knowledge and consent of all the interested parties.
4. He should regard and maintain as confidential any information obtained by him relating to the business affairs and technical methods or processes of a client.
5. He should not engage in any outside work without the full knowledge and consent of his employer.
6. When connected with any work, he should not accept commissions, outside employment, promise of employment, or any other consideration from a contractor engaged upon that work.
7. He should have no business dealings or connections with any client of his employer without the full knowledge and approval of his employer.
8. He should entertain no offers of employment or other considerations from a third party, when such may in any way influence his actions or decisions with respect to the relations which may exist between such third party and the engineer's employer or client.
9. He should not accept commissions or other considerations for specifying or recommending supplies, equipment or service.
10. He should not split fees as commissions for securing work, nor work with other engineers on a split-fee basis unless assured that his client is not deceived.
11. He should have no interest direct or indirect in any materials, supplies or equipment used in the construction work of his client or in any firms receiving contracts for his client's work without informing his client in advance of the nature of such interest and obtaining his sanction.
12. He should not engage in the independent practice of engineering without the knowledge and sanction of his employer, and under no circumstances should he compete with his employer on the basis of lower fees.

Part III—Relations to Employees

1. The engineer should treat his employees or subordinates in a spirit of fairness, with due regard and consideration for their welfare and professional advancement.
2. There should be a professional bond between employer and employee when both are engineers, which will dictate and impel reciprocal interest and mutual consideration.
3. The engineer should pay adequate salaries commensurate with the importance and responsibility involved in the service.
4. He should encourage the professional pride of his employees or subordinates in their work and should offer them every means of protecting their reputations and the quality of the work entrusted to them by not interfering with the performance of the duties for which they are responsible.
5. He should recognize the freedom of his employees to change employment and should in no way hinder employees or subordinates on bettering their condition.
6. He should not discharge an employee, nor withhold employment from him, nor discriminate against him in any way on account of his affiliations or activities in any professional, political, or religious body.
7. He should respect his employee's right to freedom of thought, speech, and outside activity as long as the same does not impair the efficiency and value of the employee's service.
8. He should see that his employee is adequately covered by insurance against risk of casualty arising from his work.
9. In advertising or offering employment, he should refrain from any misrepresentation as to the conditions and permanency of such employment.
10. If in public employ, he should assume the responsibility of consistently protecting the interests of his subordinates.
11. He should make every effort to provide steady employment for his employees and when forced to discharge an employee he should give the most generous notice possible and exert every reasonable effort to assist the employee in finding another position.

Part IV—Relations to Other Engineers

1. The engineer should not by word, act, or omission injure falsely or maliciously, directly or indirectly, the professional reputation, prospects, or business of another engineer.
2. He should not attempt to supplant another engineer after definite steps have been taken toward his employment.
3. If employed in conjunction with another engineer, and by the same client, he should not review and comment conclusively upon the work of the other engineer except with his full knowledge and consent or unless the connection of such other engineer to the work has been terminated.
4. He should not use unfair means to effect his professional advancement or to injure the chances of another engineer to secure and hold employment.
5. He should not attempt to inject his services into a project at the expense of another engineer who has been active in developing it.
6. He should not interpose between other engineers and their clients when unsolicited. When solicited, he should avoid any possibility of doing a brother engineer injustice.
7. He should not seek or solicit a position occupied by another engineer.
8. He should not attempt to secure work on the basis of lower salaries or fees.
9. He should be courteous, fair, considerate in his dealings with other engineers.
10. He should not criticize the work of other engineers except when regularly engaged to do so; and he should not attempt to secure the work for himself through criticism.
11. He should not commercialize his affiliations with, or official position in, any technical organization.
12. He should not use his professional affiliations to secure the confidence of other engineers in speculative enterprises.
13. As a member of any professional organization, he should avoid any act tending to promote his own interest at the expense of the dignity and standing or the organization.
14. As an officer of a professional organization, he should seiulously avoid any appearance of using his position for personal advertising.
15. He should co-operate in upbuilding the engineering profession by exchanging professional information and experience with his fellow engineers and students of engineering and by contributing to the work of engineering societies, schools of applied science, and the technical press.
16. He should regard himself as a debtor to his profession and should dedicate himself to its advancement.

MEN YOU SHOULD KNOW ABOUT

A. Chester Beatty has left England for France.

Roy H. Elliott is in Randsburg, Calif., on professional business.

Robert Linton was recently in San Francisco en route to Arizona.

H. G. S. Anderson is engaged in professional work in Bisbee, Ariz.

Frederick Bradshaw has returned to San Francisco from Colorado points.

F. H. Moffit, of the U. S. Geological Survey, has arrived at Cordova, Alaska.

Stephen Birch, president of the Kennecott Copper Corporation, is at McGill, Nev.

Andre Surney has gone to Rumania for La Compagnie Financiere Belges des Petrols.

H. C. Dudley, of Duluth, is now residing at Pasadena. He was in San Francisco early in May.

Prof. Alan M. Bateman, of Yale, has left for British Columbia and Alaska on professional business.

E. A. Julian, general manager of the Goldfield Consolidated Mining Co., is in Reno from San Francisco.

Joseph C. Finagin, Jr., has resigned as superintendent of the White Hills Mining Co., of Chloride, Ariz.

Jerome A. Hilbert is now at Pozos, Guanajuato, Mexico, in charge of the Angustias y Dolores properties.

W. G. Devereux has removed his office from 729 Call Building to 1209 Hobart Building, San Francisco.

Charles G. Maier, assistant director of the metallurgical research bureau of the University of Utah, has resigned.

James W. Paul is acting chief mining engineer of the Bureau of Mines during the absence in Europe of George S. Rice.

Djevad Eyoub is going to Mexico as geologist for Henry L. Doherty & Co. His address is Apartado 285, Tampico, Mexico.

Tallmadge Kyner has been in Boston, New York, and Washington during the last week or two, but expects to return to Denver next week.

Edward Steidle, of the Carnegie Institute of Technology, has completed a field study of underground conditions at United States coal mines.

Paul T. Bruhl, mill superintendent, New York & Honduras Rosario Mining Co., is visiting mills in Nevada. He will return to Honduras in July.

E. P. Mathewson, formerly consulting engineer for the Granby Consolidated Mining, Smelting & Power Co., is not now connected with that company.

L. R. Clapp, formerly assistant manager for the Granby company at Anyox, has been made manager of the company's plant at Copper Mountain.

L. D. Gordon, president and general manager of the Round Mountain Mining Co., has returned to Round Mountain from a business trip to San Francisco.

Richard Rowe, of Hamilton, Wis., formerly captain at the Ottawa mine, is now holding a similar position at the Montreal mine of Oglebay-Norton & Co.

Herbert R. Hanley, associate professor of metallurgy at the Missouri School of Mines, Rolla, Mo., has returned to California for the summer season.

H. N. Lawrie

H. N. Lawrie is acting in an advisory and consulting capacity for the Senate Commission of Gold and Silver Inquiry.

J. A. Bancroft, professor of geology at McGill University, will spend the summer vacation at Anyox in an endeavor to extend the Granby company's orebodies.

W. E. Cockfield, of the Canadian Geological Survey, passed through Vancouver on May 23 on his way to the Yukon district southeast of Whitehorse, where he will conduct investigations this summer.

J. C. Carroll, instructor in physics in the school of mines and engineering, University of Utah, has been given a year's leave of absence. His place will be filled by **Henry W. Oddie.**

Axel P. Ramstedt, of Wallace, Idaho, comptroller for the Day mines (Hercules and Tamarack), is in New York and will also visit Washington on business connected with those companies.

Dr. Fredrick Leslie Ransome, for many years prominent with the U. S. Geological Survey, has accepted the position of professor of economic geology at the University of Arizona.

U. C. Tainton, of the metallurgical staff of the Bunker Hill & Sullivan Mining & Concentrating Co., has returned to Kellogg, Idaho, after a visit to New York on professional business.

Prof. A. C. Lawson, of Berkeley, Calif., has been in Tonopah, having been retained by the West End Consolidated Mining Co. in its coming apex suit with the Tonopah Extension Mining Co.

O. C. Martin, recently manager of the Nichols Copper Co., at Laurel Hill, Long Island, has joined the technical staff of the American Smelting & Refining Co., in charge of the Perth Amboy, N. J., plant of the last-mentioned company.

C. P. Clapp, of Missoula, Mont., president of the University of Montana and formerly president of the Montana School of Mines, at Butte, arrived in Wallace, Idaho, on May 24 and visited several of the larger mines of the district.

Prof. B. Rose, of Queens University, Kingston, Ont., has been associated with **A. G. Burrows**, of the Ontario Department of Mines, in the investigation of the Porcupine gold area. **W. R. Rogers**, of the department, will direct the topographical survey of the area.

W. R. Wade, manager of the Northern Ore Co., of St. Lawrence, N. Y., in company with **O. M. Cozzens**, mill superintendent, recently visited the southeast Missouri lead district around Flat River. He has been elected to the board of directors of the Northern company.

Henry C. Boydell is making an examination of the Eureka mining district of Eureka, Nev., as assistant to **Dr. Waldemar Lindgren**, who is making for the United States Smelting, Refining & Mining Co. a geological investigation of that company's extensive interests in the Eureka district.

Joseph P. Johnson, of Toronto, has been attached by the Ontario Department of Mines to the survey party sent out by the Department of Lands and Forests to run a meridian line from the Canadian National Railway to the Albany River. Mr. Johnson will report on the geology of the region.

Sam Houghton, late superintendent of the Hanover Bessemer Iron Co., of Fierro, N. M., and now manager of the Graphic lead mine, at Cooks Peak, near Deming, N. M., has just returned from a trip to New York and eastern points and is preparing to reopen the famous old Graphic mine, on an extensive scale.

Jerome J. Day and **Axel P. Ramstedt**, of Wallace, Idaho, are in New York City. Mr. Day is president and general manager of the Tamarack & Custer Consolidated Mining Co. and Mr. Ramstedt is comptroller for the Tamarack & Custer, the Hercules, and other mining companies controlled by the Day interests.

George Wilkinson, formerly chief inspector of mines for British Columbia, but who resigned in the spring of 1920 to become general manager for the Pacific Coast Coal Co., has been reappointed chief inspector of mines for British Columbia, on the retirement of James McGregor, who had held the position since May, 1920.

THE MINING NEWS

The Mining News of ENGINEERING AND MINING JOURNAL-PRESS is obtained exclusively from its own staff and correspondents, both in the United States and in foreign fields. If, under exceptional conditions, material emanating from other sources is published, due acknowledgment and credit will be accorded.

Leading Events

SENATOR PITTMAN questions practice of the smelting companies in "selling" 100 per cent of the silver in domestic ores from which only 95 per cent is recovered. Thinks metallurgical losses are made up by silver of foreign origin.

The Walker Mining Co. will increase the capacity of its flotation plant in the Plumas copper belt of California.

Operators in the Coeur d'Alene district, in Idaho, see the market for lead rather than for silver as the chief factor governing their prosperity.

Reorganization of the Batopilas Mining Co. of Chihuahua must precede financing further operations.

The Granby Consolidated has renewed its bond on the property of the British Columbia Pyrites Co.

Randsburg, in southern California, is the scene of active prospecting, development, and production of silver.

The Bellehelen cyanide plant, 50 miles east of Tonopah, is ready to start.

The United States S. R. & M. Co. is making a thorough examination of the Asuncion properties near Guanajuato, Mexico.

Tin smelting in the United States is a vanishing industry. The A. S. & R. plant at Perth Amboy will shut down July 1.

Shareholders of Esperanza, Ltd., operating in Mexico, find the company in serious financial straits.

Michigan copper production is at the maximum, depending only on the labor supply.

Bellehelen Mill and Cyanide Plants Are Started

Plant East of Tonopah Will Use Oil-Engines for Power—$32.50 Ore Will Be Treated

The new 50-ton mill and cyanide plant of the Bellehelen Merger Mines Co. at Bellehelen, 50 miles east of Tonopah, started operating on May 24. Excavation for mill foundations was begun in January, and the date of completion is one month later than originally planned, the delay being due to severe weather conditions and minor causes. Electric power is generated by two oil-burning engines of 100 and 150 hp., which is sufficient for both mine and mill requirements. The mill will be operated for the present on mine ore, but later custom ore will be treated.

The vein is opened by a crosscut tunnel, with sundry drifts, and raises and a winze. The surface showing of the vein is weak, but the vein appears to widen going down, without any diminution in values, and at the bottom of the 100-ft. winze is better than at any point above. Work has recently been resumed in the winze, and stations for convenience in mining will be cut at appropriate points. Before taking over the property the company's engineers estimated probable and positive ore reserves as 14,000 tons of $32.50 ore. This estimate did not take into consideration the excellent showing below the tunnel level, and included only ore above the tunnel, so that a reasonable life for the property seems assured.

Reorganization in Prospect for Batopilas, Mexican Company

The mortgage held by the bondholders on Batopilas Mining Co.'s silver mines, in southwest Chihuahua, probably will be foreclosed, as not enough stockholders have approved the voluntary assessment of 60c. a share to satisfy the bondholders and provide working capital. Only 10 per cent of the 2,500 shareholders, representing about 11 per cent of the 450,000 shares of outstanding stock, replied to the request of the management for approval or disapproval of the proposed assessment. Most of the answers were in favor of the assessment.

The company owns about 750 acres of mining ground, much of which is unexplored. Improvements include amalgamation and cyanide plants, power house, and general buildings that cost originally more than $1,800,000. Two tunnels for exploiting the property cost over $900,000. The company was organized in 1880, and for thirty years the property was a famous bonanza producer, with average annual silver output of $379,000, though yearly production varied greatly.

In 1919 the property, after a shutdown due to the revolution, was placed in working order, and production for 1920 was $109,000 and for 1921 $91,000. No new rich orebodies were found and working low-grade bodies was not profitable. The company's bonded indebtedness is $366,500, and on December 31, 1922, interest due totaled $98,955. It is understood that after foreclosure a reorganization will be undertaken.

A. S. & R. Will Shut Down Perth Amboy Tin Smelter

Last of Five Plants Built During the War Will Have Discontinued Operations by July 31

The American Smelting & Refining Co. states that it will close its tin smelter at Perth Amboy, N. J., July 1, owing to inability to get further supplies of Bolivian tin concentrates in competition with English tin smelters, which are able to smelt at much lower cost because of cheaper labor and supplies. It is understood that the only other tin smelter still operating in the United States will close about July 31. The shutting down of five plants is accounted for in part at least by the failure of Congress to place a tariff upon tin.

Last year the tariff clause providing protection on pig tin to balance the difference in cost of smelting here and abroad was defeated in the Senate. This tariff, tin interests argue, would have brought practically all Bolivian tin concentrates to this country for smelting and refining into pig tin.

During the war American inventive genius perfected at the Perth Amboy plant an electrolytic refining process that turned out tin equal, if not superior, for plating or other uses, to any tin refined elsewhere. It was hoped Congress would pass the tariff on pig tin so as to encourage further expansion of this war-developed industry. Incidentally, trade with South America would have been stimulated by supplying return cargo for ships.

Coeur d'Alene Operations Will Not Be Curtailed by New Silver Price

Drop of 35c. Per Oz. Will Cut Millions from Income, But Activity Hinges on Lead Price

By A. J. Dunn

The termination of silver purchases by the government under the Pittman Act is not expected to result in any curtailment of mining operations in the Coeur d'Alene district, Idaho. That it will make a material reduction in the profits is, of course, evident, but it is the price of lead rather than the price of silver that is the controlling factor in the Coeur d'Alene district. Silver is important, and in years past when lead dropped to extremely low price levels, silver has been the salvation of the industry, marking the difference between profit and loss. Nevertheless it is and has been regarded as a byproduct. This is clearly reflected in the annual statements filed by the mining companies showing their net profits. Last year, 1922, the total net profits of the mines were only $3,587,793, although the price of silver throughout the year was $1 per ounce. The average price of lead for the year was 5.73c., a fair average, but during the first few months of the year the price was at a figure that caused several large producers to remain inactive until the last half of the year in spite of $1 silver.

In 1915 the average price of lead was 4.7c. per pound and silver was 50.7c. per ounce. That was two years before the United States entered the war, and mining costs were much lower than they are now. In that year the net profits were $9,794,632. In 1916 the average price of lead was 6.9c. per pound and the average price of silver was 65.8c. per ounce. Operating costs were moving upward, but Coeur d'Alene mines in that year earned a net profit of $12,154,629. In 1917 the average price of lead advanced to 8.6c. per pound and silver reached an average of 82.4c. per ounce. There was also further advance in operating costs, but in that year the mines reached the peak of profits, $12,765,113. It is evident from these figures that even if the price of silver drops to the present foreign price and lead continues around the present price level, 7.25c. per pound, Coeur d'Alene mines will continue to earn an excellent profit, just as they did before they were favored with dollar silver. They would, however, be subjected to a heavy decrease in profits, for they are large producers of silver. In 1917 the production of silver was 11,715,000 oz., for which the average price was 82.4c. per ounce, giving it a value of $9,653,160. At the present foreign price, 67c., the value would be only about $7,810,000. Last year when production dropped on account of the low price of lead, the mines produced only 4,697,517 oz. of silver, for which $1 an ounce was received. Based upon the prevailing foreign price, the value of the product would be about a third less, or $3,131,678. Thus, while the price of lead is the controlling factor, and the mines will continue in profitable production while that price is maintained about the present level, the anticipated drop in the price of silver means a substantial reduction of profits.

During May the Bunker Hill and Sullivan smelter produced 4,000 tons of lead and 180,000 oz. of silver. Large tonnages of Coeur d'Alene ore went to Helena, Mont.

Granby Renews Bond on Pyrites Property in B. C.

Copper Content of Ore Low—Sulphuric Acid Manufacture May Warrant Exploitation

The Granby company has taken a bond on the British Columbia Pyrites Co.'s property for $250,000. The property is situated on Red Gulch Creek, 30 miles up the Ecstall River, which is a tributary of the Skeena River. The Granby company had this property under option in 1920, and did a considerable amount of diamond drilling. At the time that the bond was relinquished the manager of the company announced that an immense body of pyrite had been found, but the copper content was too low to make it valuable at that time, though should a demand for sulphuric acid arise in the Province the property should be of considerable value. It is assumed that the growing demand for sulphuric and sulphurous acid in the manufacture of paper has caused the company to reconsider its former decision. H. S. Munroe, manager for the Granby company, has announced that the work in connection with the property will be entirely of a metallurgical nature, to determine the availability of the ore for commercial purposes. The ore is said to run between 40 and 50 per cent in sulphur, 0.05 per cent copper, and $1 per ton in gold.

Battle Expected at Dome Annual Meeting

The annual meeting of the Dome Mines, of Ontario, which will soon be held, promises to be an interesting affair, as proxies are being solicited in favor of Ernest C. Whitbeck and Jacob G. Rosenburg, of Rochester. The recent raid against the stock, which succeeded in breaking the price about $10 a share, will no doubt be of assistance to these gentlemen in obtaining proxies.

It is understood that it is not the intention to try to elect a new board of directors, but some of the larger shareholders who are not satisfied with the dividend policy of the company want representation on the board. The president has stated that in July the dividends will be doubled, but it is not certain that this action will meet with the approval of all of the present directors.

The company is now treating about 1,250 tons a day, and production is approximately $400,000 a month, from which large profits are being realized.

United States S. R. & M. Co. Is Examining Asuncion Properties

Mines Near Guanajuato May Be Operated on Large Scale— Silver-Gold Ore Claimed

By Keith A. Cunningham

George W. Bryant, who, with associates, holds an option on the properties of the Asuncion company, in Guanajuato, Mexico, has concluded a preliminary agreement with the Compañia del Real del Monte y Pachuca under the terms of which the latter company will, subject to being satisfied with the result of an examination, take the properties over and prepare and equip them for operation on a large scale.

The properties of the Asuncion company are situated in the La Luz district, some seven miles from Guanajuato, and comprise most of the famous old mines of the district, a 100-stamp mill and cyanide plant, mining equipment and a large reservoir. The mining claims cover an area of approximately 1,700 acres, and include such well-known mines as the Villariño, Jesus Maria, El Refugio, San Juan, Santa Clara, San José, Asuncion de la Navarra, La Luz, and many others of less importance. Many of the mines were large producers in the past, and it was on what are now the claims of the La Luz mine, near the portal of the San Bernabé tunnel, that silver was first discovered in the Guanajuato district in 1555. It is claimed that there are large tonnages of more or less easily accessible ore, consisting of dumps, fills, and ore in place, in these mines, and that the possibilities for extensions of the orebodies, both in depth and on the strike, are great. The ore is of low grade, probably averaging, with silver at present price, about $8 per metric ton, but as it is of a clean siliceous nature, it is easily and cheaply treated, leaving margin for a fair profit. The values are in silver and gold, roughly about $5 in the former and $3 in the latter metal.

The Compañia del Real del Monte y Pachuca is the Mexican subsidiary of the United States Smelting & Refining & Mining Co., and operates several mines and two large mills and cyanide plants in the Pachuca district. The company has already sent J. G. Reilly to begin the examination of the Asuncion company's properties, and some hundreds of men are being put to work cleaning and opening up the old mine entrances and workings, many of which, after lying idle for many years, are in bad condition. It is understood that D. S. Calland, general manager; R. W. La Montagne, chief engineer, and other employees of the examining company will arrive in the camp during the course of the next few days. Should the negotiations succeed the transaction will be the largest that has ever been consummated in the camp and a large enterprise will be established with ample capital for economical operation.

Many Companies Hunt Silver Ore at Randsburg, Calif.

California Rand Silver Shipped 1,050 Tons of Ore and 520 Tons of Concentrate During April

An average of four cars of mining machinery and supplies is being unloaded daily at Randsburg, Calif., more than a dozen companies being actively engaged in developing showings already opened or in prospecting their claims. The California Rand Silver, Inc., the principal shipper, milled 9,700 tons of silver ore during April and shipped 1,050 tons of high-grade ore and 520 tons of concentrate to the smelter. Total dividends during the past forty-three months are $2,416,000, or $1.87½ per share.

During the past winter experiments with a one-ton experimental plant showed that the company can smelt its concentrate in a small plant at the mine.

The neighboring Coyote company is sinking shafts on the Coyote No. 2 and on the Santa Fe claim both located adjoining the California Rand's No. 6 shaft. On Foster No. 1 this company has taken over the Fox lease, on which the shaft is now down 775 ft. On this level, at 520 ft. a 12-in. vein of ruby silver ore that will average $20 was cross cut. At 578 ft. the miners went through 12 ft. of vein matter, but further development will have to prove an oreshoot.

Between the Coyote and No. 6 shafts is the Silver King mine, a producer of high-grade ore. The find was made at 603 ft. in the shaft. The mine is now stoping from the 700 level and shipping at irregular intervals.

The Grady shaft is developing a better grade of ore, both on the eighth and tenth levels.

The Garford and Ratcliff lease has showings of ruby silver in its workings on the 300 level.

The K. C. N. lease, where silver was first discovered by Hamp Williams, will soon be equipped to resume the shipping of silver ore.

Over in the gold zone the Yellow Aster is running ten stamps continuously on leasers' ore. The company is just finishing a new road to a mill-site, over which a ball mill will be hauled. West of Camp, adjoining the Yellow Aster and the Minnehaha mines, the Big Gold is sinking a deep shaft. This development is being watched closely by the owners of properties in that part of the district.

Both the Big Butte and the King Solomon mills are running on company ores. Quartz showing course gold was found on the 300 level of the King Solomon. With further advance it is hoped to find the "jewelry rock."

Special Train Hauls Silver Ore!

In its haste to get silver concentrates into the smelter yards before the Pittman Act purchases were completed, the Vipont Mining Co. chartered a special train to carry its mill product from the mine to Box Elder County to a Salt Lake valley smelter.

How U. S. Copper Is Used

Copper consumption of the United States in 1922 is estimated by the American Bureau of Metal Statistics at 1,091,397,000 lb., compared with 904,753,000 lb. in 1921, 1,346,090,000 in 1920, and 1,224,710,000 in 1919. This consumption was divided as follows, the figures representing thousands of pounds:

U. S. Copper Consumption (In Thousands of Pounds)

	1922	1921	1920	1919
Electrical equipment[1]	269,000	260,000	340,000	284,000
Telephone and telegraph	120,000	108,000	122,000	81,000
Light and power lines[2]	97,500	66,000	59,000	54,500
Wire and rods	91,000	77,000	107,000	90,000
Automobiles[3]	144,000	92,000	120,000	97,000
Auto brake lining	1,600	1,400	1,150	900
Buildings[4]	73,900	44,300	69,000	61,200
Locomotives	5,030	5,890	11,860	10,350
Railway cars	7,470	5,480	8,570	16,770
Air brakes	5,600	3,350	5,600	5,900
Ships, commercial[4]	6,180	38,000	62,000	102,000
Ships, naval[4]	170	9,900	14,100	22,500
Bearings and bushings	42,000	28,000	84,000	80,000
Valve and pipe fittings	20,000	11,500	25,000	25,000
Ammunition	14,500	16,500	23,400	23,000
Lubricators	5,500	1,600	6,000	6,300
Condensers	4,800	4,000	6,000	6,000
Fire-fighting apparatus	3,100	2,300	4,000	3,400
Agricultural machinery	500	720	1,000	1,000
Cash registers	1,000	400	1,340	1,300
Copper bearing steel	1,900	1,700	2,300	2,300
Coinage	475	2,930	3,150	2,075
Other uses[5]	95,000	72,000	105,200	90,250
Manufactures for export	81,172	51,783	164,420	157,965
Totals	1,091,397	904,753	1,346,090	1,224,710

1 Generators, motors, switchboards and lamps, exclusive of telephone and telegraph purposes.
2 Outside wiring only; does not include trolley lines.
3 Does not include electrical manufactures.
4 Does not include electrical generators, motors and similar apparatus.
5 Includes rods, wire, sheet, tubes and all similar fabrications of copper for export as reported.

Walker Mining Co. Will Enlarge Mill at Portola, Calif.

The Walker Mining Co., a subsidiary of the Anaconda Copper Mining Co., has completed plans for increasing the capacity of its concentrator at Portola, in Plumas County, Calif. The new plant will be sufficiently large so that it will be unnecessary to ship crude ore to the International Smelter at Tooele, Utah. Two hundred and fifty men are now on the payroll. A long aerial tram that carries the mill product from the mine to the railroad has been overloaded.

Drilled Six Feet in Five Minutes Fourteen Seconds at Miami, Okla.

In a district drilling contest held at Miami, Okla., recently, Fred Vickery and Harold Miles, of the Premier mine, once more became the champion drillers of the field, an honor they lost to A. Abbott and A. E. Mitchell at Baxter in the fall of 1920. A special boulder of concrete 6 ft. thick was provided for the contest and Miles and Vickery, using a Denver Turbo drill, completed the task of setting up their machine, penetrating the rock, and tearing down, all in 5 min. and 14 sec. The first prize was $100.

E. Coulter and F. Rickey, of the Black Eagle mine, won second prize, $50, their time being 5 min. 35 sec. C. Hoover and O. Standefer, of the Oko mine, won third place, their time being 5 min. 48 sec. Ray Mitchell and Claud Grant, of the Big Elk mine, won fourth place, with 5 min. 55 sec.

The contest was largely attended and created much interest.

Explosion at Apache Powder Works Killed Four

Plant Owned by Arizona Copper Companies—Competes with Big Explosive Manufacturers

An explosion that occurred at the plant of the Apache Powder Co., at Apache, Ariz., on the morning of May 23, killed four men, severely injured another, and totally wrecked five small buildings that were used for mixing houses. Fire immediately afterward destroyed a warehouse containing a small stock of powder and threatened other buildings. This is the first disaster to take place at the powder factory since it was started, over fourteen months ago.

The Apache company is owned by the large copper companies of Arizona, who subscribed for the total stock of the organization, which was created by the producers in an attempt to get cheaper supplies for the industry and also effect a saving in freight rates by centrally locating the plant with respect to the users. About 150 men are now employed at the factory and production has been averaging a carload of explosives per day. Production had only recently been increased to that amount when expansion of mining activity made it necessary for the addition of a night shift if the rate of output was to keep up with the demand.

The cause of the explosion will never be ascertained, but it is agreed that it was only a miracle that greater damage was not done, as investigation revealed that the blast had been carried along pipes right to the base of large storage tanks from which the liquid was conveyed to the mixing houses. The building covering these supply tanks was wrecked, but they did not explode. The production of the company will be curtailed until the damaged portion can be replaced, but it is thought that the unit that was untouched by the explosion will not be affected.

It is worthy of note that accidents in powder plants are comparatively rare, because of the extreme caution used.

A. S. & R. Plans $4,000,000 Investment to Supply Own Smelter Coke

Extensive development operations of the Rosita coal field near Sabinas, State of Coahuila, Mexico, have been started by the American Smelting & Refining Co., which purchased the property some time ago. It is stated that the company will expend more than $4,000,000 in constructing coke ovens and other improvements. According to the statements of engineers who have been exploring the coal field, approximately 100,000,000 tons is available for converting into high-grade coke. The output of the coke ovens will go to supply the smelters of the company at Monterey, Asarco, Chihuahua, and Aguas Calientes, thereby reducing the cost of operations somewhat.

News from Washington

By PAUL WOOTON
Special Correspondent

"Metallurgical Losses" May Have Been Made Up by Foreign Silver

Senator Pittman Grills Smelter Officials—Thinks Miner Unfairly Treated—Possibility of Extension of Purchases—Further Investigation

METALLURGICAL LOSSES of smelting plants in connection with the treatment of silver were discussed in detail at a hearing on May 31 before Senator Pittman, of the Commission of Gold and Silver Inquiry. Representatives of the American Smelting & Refining Co., the Anaconda Copper Mining Co., the United States Smelting, Refining & Mining Co. and of the Bureau of the Mint were heard. The hearing was a part of the investigation of government silver purchases, to which Senator Pittman was assigned by the commission. Senator Oddie, the chairman of the commission, however, participated in the hearing.

Senator Pittman sought an explanation for the deduction of 5 per cent by smelters for metallurgical losses. If 5 per cent of the silver content of ore is lost during the treatment process, there is a wide discrepancy between the amount of silver purchased by the smelters and the amount which they sold to the government.

F. H. Brownell, the vice-president of the American Smelting & Refining Co., in the course of his testimony stated that the 5 per cent deduction accredited to metallurgical losses is an arbitrary one. The actual metallurgical losses, he said, at the plants of his company are around 1 per cent of the silver content of the ore. He declared, however, that producers of silver generally are familiar with the fact that this 5 per cent deduction is an arbitrary one made in lieu of higher smelting charges. At the request of Senator Pittman, Mr. Brownell promised to furnish for the record correspondence or other proof to substantiate his statement that producers have been acquainted with the fact that metallurgical losses are less than 5 per cent. In that connection it was pointed out that the losses are greater than 1 per cent at some smelting plants.

As the Bureau of the Mint is authorized to pay $1 an ounce for the silver covered by producers' affidavits, it is suggested that a portion of the tenders which have been made by the smelters may not come within the act and must be deducted from the total purchases now credited as Pittman silver. There is also involved, at smelters operating on foreign and domestic ores, the intricate question of determining the domestic origin of the silver covered in the item of "metallurgical losses." Should silver "metallurgically lost" be excluded from the Pittman purchases it would mean that an additional 6,000,000 oz. according to one estimate, could be bought at $1 an ounce. The inference is that the mint has erroneously purchased foreign silver from the smelting companies.

A further hearing on the matter of metallurgical losses is to be held in New York when the commission's auditors have pursued their investigations further. During the course of the hearing, Senator Pittman called attention to the fact that the tenders of silver since the beginning of the current year have been entirely disproportionate as compared with tenders during the corresponding months of other years. In 1920, the purchases of silver averaged 3,738,420 oz. monthly; in 1921, the monthly average was 4,888,542 oz., and in 1922 the monthly average was 5,181,752 oz. In March, 1923, the amount tendered during that month reached the unprecedented total of 16,215,394 oz. The monthly average for January, February, March, and April, 1923, was 8,044,166 oz.

The Department of Commerce has reported to the commission that exports of silver in 1922 were valued at $62,807,286, and that silver to the value of $70,806,653 was imported during that year. At the request of the commission, the Department of Commerce now is compiling the names of the consignees and consignors of the silver both imported and exported in 1922.

The commission has asked the State Department to submit requests for the following information to the governments of Mexico, Chile, Bolivia and Canada:

1. The names and addresses of the producers of silver in the country of the government addressed who reported production in 1922 and the number of ounces reported by each. If for confidential reasons a report of the production of each producer cannot be furnished, please group the producers between certain limits of production, so that a general idea of the magnitude of each producer's output may be obtained.

2. The total production of silver in the country of the government addressed in the calendar year 1921 and 1922 in fine ounces, segregated to indicate the amount derived from ores not requiring smelting and the ores of copper, lead, lead-zinc, and copper-lead-zinc, in accordance with the usual classification.

3. The number of ounces of refined silver produced in the country of the government addressed in the calendar year 1922, through smelting, milling, and refining operations and the number of ounces of silver contained in ore, matte, concentrates, or unrefined silver bullion exported to the United States for smelting, milling, or refining.

4. The name and addresses of the principal consignors and consignees in the country of the government, addressed of silver bearing ores, matte, concentrates, or unrefined bullion and approximately the number of fine ounces shipped by each exporter to the United States in the calendar year 1922.

The commission suggests "that the securing of the above indicated information from the governments addressed will be expedited if, accompanying the request, a statement be made to the effect that the commission contemplates calling a conference of the silver producers of Mexico, Canada, and the South and Central American countries to meet with the producers of this country in Reno, Nev., some time during the summer to discuss the organization of a silver-marketing association."

Lewis Paints Gloomy Picture of British Coal Industry

The coal industry in England is in a bad way, in the opinion of John L. Lewis, president of the United Mine Workers of America. The wage being paid mine workers in England, based as it is on the selling price of coal, is insufficient, Mr. Lewis told the President's Coal Commission, to allow the workers to live in other than a state of poverty. Mr. Lewis left the impression with the commission that the British producers are in no position to increase the price of coal. The situation, however, has been improved somewhat by the increased demand for British coal which has grown out of the occupation of the Ruhr.

Chairman Hammond and Dr. Smith, who represented the commission at the conference with the press on June 1,

would give little additional information as to what had been told them by the Mine Workers' president. They did state positively that there had been no discussion of the anthracite wage scale. One of the points which Mr. Lewis brought to the attention of the commission, Mr. Hammond revealed, was that of the relative productivity of the average mine worker in America as compared with the average mine worker abroad. Mr. Lewis declared that the American mine worker is several times as efficient as the foreign coal digger. He pointed out, however, that British coal mines are safer places to work in than are the mines in the United States. Mr. Lewis made the point that there must be closer co-operation between operators and their employees looking to the lowering of the accident hazard.

Whether or not the separate branches of the coal industry are through throwing mud at each other, the commission is confident that it is to receive the constructive suggestions which each interest has promised. The railroads have submitted a statement which Chairman Hammond describes as "constructive." At the press conference there was some discussion of a suggestion by Commissioner Potter of the Interstate Commerce Commission that the railroads be prepared at any time to furnish the cars necessary to transport 15,000,000 tons a week. Apparently Commissioners Hammond and Smith were not prepared to accept the practicability of such a plan.

War Minerals Commission Must Unravel Complicated "Stimulations"

Solicitor Objects to Government Reimbursing Expenditures that Were Already Planned—Argument Seems Sound

AN OPINION by the Solicitor of the Interior Department promises to have a far-reaching effect on War Minerals Relief claims in that it requires a differentiation between sources of stimulation.

"I can not agree," says the solicitor in his opinion, which has been approved by the secretary, "that when several stimulations are operating and then a stimulation is given by the government, that from the time of the government's stimulation the government should be liable for all expenditures just as if the stimulation of the government had been the sole and the only stimulation. If several stimulations combine and the government's stimulation is but one of several stimulations, in my opinion the government becomes liable only for the results of its own stimulation and not for the results of all the stimulations. An effort in all cases should be made to follow the results of the government's stimulation.

"If non-governmental stimulations are in operation, and then a stimulation by the government is made and is added to the then operating and existing non-governmental stimulations, but does not cause the claimant to do anything he was not doing already under existing stimulations, then, in my opinion, the government should not pay for any expenditure after its stimulation began, because its stimulation, while combining with other stimulations, did not produce or cause any expenditure that would not otherwise have been made. The results of each stimulation should be traced separately when possible, to the end that the government should not be held liable for stimulations non-governmental."

The opinion was rendered in connection with the claim of the Western Utah Copper Co. The mine involved was begun as a copper prospect, but later was operated principally for its tungsten content. The claim was disallowed on the ground that the stimulation was non-governmental.

John Briar, the War Minerals Relief Commissioner, has recommended, and the Secretary of the Interior has approved, an award of $1,878.93 in the tungsten claim of Mrs. C. M. Cordes and $743.42 in the tungsten claim of William Long. Disallowances follow:

John H. Heron, manganese, stimulation not established; L. H. Dobson, tungsten, net loss not established; O. B. Pancost, tungsten, net loss not established; Baker Hot Springs Manganese Co., manganese, no additional award justified.

Hydraulic mining for tin in the Federated Malay States

News by Mining Districts

By Special Correspondents in the Field

London Letter

Esperanza in Serious Financial Difficulties; Shares Drop—Mining Exhibition in London

BY W. A. DOMAN

London, May 24 — Shareholders in Esperanza, Ltd. (Mexico) have had an unpleasant shock. Expenditure last year and the early months of 1923 has proved so heavy that it is difficult to obtain either cash or bank advances to meet pressing creditors, and unless money can be found the mine must shut down. The present indebtedness of the Mexican company is $165,000, and $105,000 is required for mine development, mill completion, and current supplies. If and when alterations to the plant are completed, it is estimated that 30,000 tons monthly of low-grade ore can be treated at a profit of 50c. per ton, the low-grade reserve tonnage being estimated at 1,000,000 tons. Hugh Rose, general manager of the Mexican Corporation, has confirmed these figures. It is proposed to reorganize the capital with 1,140,000 shares of 10s. each. Shareholders are to subscribe for five new with 8s. paid for every two now held. This will provide £113,750. A week or so ago the shares were selling for 11s. or 12s., and on the publication of the details of the proposed method of refinancing the company they dropped to under 5s., as the liability equal to 5s. a share is not liked. Nothing is said about developments on the Descubridora vein, upon which large sums have been expended.

The Messina (Transvaal) Development Co. has made an arrangement with the South African Government to resume operations, the authorities having agreed to grant a bonus of £5 per ton up to 2,000 tons, as this is the quantity needed for the electrification of a section of the Natal Railways. As a result, the staff is being re-engaged and operations are being resumed.

Owing to the improvement in the diamond market, shareholders in the Consolidated Diamond Mines of South West Africa had expected the declaration of a dividend at the annual meeting. They have been disappointed, although the company could have made a distribution and carried a fairly substantial sum forward. Instead, the chairman, Sir Ernest Oppenheimer, pointed to the payments required for the debenture service. No dividend seems to be likely for another twelve months, and as a result the shares have fallen to 20s. 9d.

Sir Abe Bailey has formed a company called West End Diamonds, to work a property in the Postmasberg district, Cape Province, about 120 miles west of Kimberley. Little in the way of development has yet been done, but for the first three months of the year 69,833 loads washed yielded 5,812 carats, valued at £17,225. The capital is £100,000 in 5s. shares.

The International Mining Exhibition will be opened at the Agricultural Hall, Islington, at the end of next week. The Sullivan Machinery Co. and the Ingersoll Rand Co. are taking space for their products. These, I believe, are the only two American firms represented.

San Francisco Letter

Association Will Have Assays for Platinum and Iridium Made—Mammoth Gestures Toward Resuming

By Our Special Correspondent.

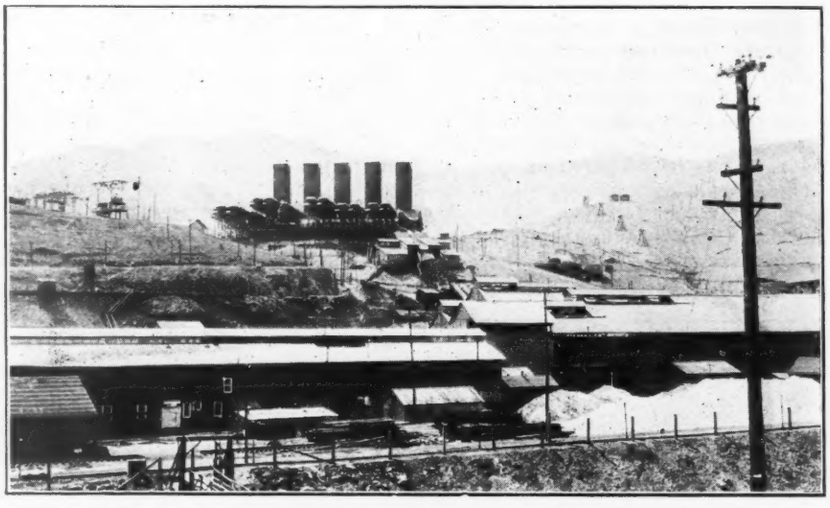
San Francisco, May 28—A practical method of assisting the prospector has been worked out by the Siskiyou Mines Association, which has perfected arrangements for the free analysis of black sands and placer concentrates suspected to contain platinum and iridium. Prospectors of northern counties have been invited to send in samples to H. J. Barton, president of the association.

The Mammoth mine, in Shasta County, according to local reports, has put a small crew of men at work at the Mammoth, Keystone, and Balaklala mines. For the present the work will consist of repairs to the surface plants at the mines. This makes the second copper mine in the county to make preparations preliminary to resumption of production

The Engels Copper Co., in Plumas County, is averaging over 1,000,000 lb. of copper per month. Work has been resumed at the Beardsley and other small properties in the district.

The Fremont, one of the recently rehabilitated properties on the Mother Lode, near Amador City, is operating twenty stamps. A systematic mill test is being made on the two classes of ore that occur in the mine. The Kennedy mine is still engaged in reconstructing its hoist. At the Plymouth the winze has been sunk to a depth of 3,982 ft., exposing a sizable orebody of good grade. Both the north and south drives on the 3,925 level have been extended in ore of good grade.

The Silvarado mine, owned by the Mono Mines Co., has resumed development. C. T. Eastman is in charge of operations. Tentative plans for a milling plant have been prepared, but these are held in abeyance pending the results of development work. The Green Creek power plant, owned by J. Kane, of Bodie, has been sold to the Mono Mines Co. As soon as the Silvarado brings in power, several properties in the Masonic district will start up. McMillan, Faudry, and Welch are reported to have made a gold strike in the Masonic district, and their claims have been bonded to E. M. Green, of San Francisco.



Plant of U. S. Smelting, Refining & Mining Co. at Mammoth Mine, Kennett, Cal., where operations are to be resumed

BRITISH COLUMBIA

Concentrator Nears Completion

In the eastern part of the province renewed activity is being shown in the Rossland district, which has lain idle for several years. This camp is now controlled by the Consolidated Mining & Smelting Co., which has been using the concentrator formerly employed in concentrating the Le Roi ores for concentrating the ores of the Sullivan mine in the Kimberly district. The new 2,000-ton plant being erected at Kimberly is approaching completion, and the Le Roi ores can again be treated in the Trail plant.

Cork Province Resumes

The Cork Province, near Kaslo, has resumed milling operations on a shoot of ore reputed to be extensive. The Florence, near Ainsworth, on Kootenai Lake, is bringing in electric power from the Nelson hydro-electric plant and developing the parallel vein recently discovered on the property.

Engineer Mine Again in Litigation

The Engineer mine, at Atlin, is again a litigant in the Supreme Court of British Columbia. Robert E. Williams, of Milwaukee, and Horace K. Williams, of Los Angeles, brothers of the late Abbie Williams Alexander, wife of the late James Alexander, claiming a one-third interest in the property, on the ground that Mrs. Alexander survived her husband, and, therefore, her heirs, and not his, are the present owners of the property.

Considering that Alexander and his wife lost their lives in the sinking of the "Princess Sophia," in the Lynn Canal, on Oct. 26, 1918, and that no one survived the disaster, it is difficult to see how it will be possible to prove whether Alexander or his wife were the first to succumb; furthermore, though a careful search has been made in both Canada and the United States, no record of the marriage of Abbie Williams to James Alexander has been found. These things considered, it seems a pity that it is possible to tie up a property as promising as the Engineer mine in a legal struggle that in the end necessarily must be futile to those who have started it. The heirs of Alexander already have had to fight three claimants, some of them through several courts.

ONTARIO

Large Reserves Based on Diamond Drilling

Directors of the Davidson Gold Mines, of Porcupine, have issued a progress report. They claim that diamond drilling has indicated the existence of 700,000 tons of ore averaging $9.25 a ton between the 500 and 1,000 levels. Previous estimates of the ore above the 500 level aggregate $3,850,000 of an average of $11 a ton. According to the directors this gives an indicated tonnage having a value in excess of $10,000,000. Estimates of this sort, based on diamond-drill results, are not satisfactory, and none of the larger producing mines consider it safe to estimate tonnage based on drilling alone. The Davidson has started a 1,000-ft. incline shaft and is making preparations to build a mill with a capacity of 500 tons a day.

South Lorrain Output Substantial

In the South Lorrain district, the Mining Corporation is obtaining a substantial production. This in April amounted to 183,000 oz., but May shipments were somewhat smaller, on account of the poor condition of the road, which prevented the ore being shipped for treatment. So far this year production of the Mining Corporation's South Lorrain property has amounted to 750,000 oz. On one shoot of the Woods vein over 1,000,000 oz. has been produced to date and there is still a substantial quantity in reserve. In the same district the Lorrain Consolidated has installed a plant and will soon start underground operations. A deal has also been concluded for the ground under Trout Lake, and sinking is to be started on this property. The Keeley is making good progress with the construction of its mill addition.

Power Still Short

Unless conditions improve, the power situation in the Porcupine district of Ontario is likely to be no better than the previous year. The spring has been exceptionally dry, bush fires are more or less prevalent and the storage basins in the rivers are low. The Sturgeon Falls plant of the Northern Canada Power Co. is not yet in operation, and the power company is unable to guarantee a supply of energy to any except the Dome, Hollinger, and McIntyre. These three mines have been increasing their capacity and are now employing the largest labor force in their history.

NEVADA

Tonopah Bullion Shipments High

Tonopah bullion shipments, representing the first fifteen days' operations in May, were larger than for some time. The Tonopah Belmont shipped $140,800, the Tonopah Mining $90,000, the West End $78,500, and the Tonopah Extension $64,000. Noticeable increases appear in the bullion from the Tonopah Belmont and Tonopah Mining companies. The Tonopah Divide is shipping over 150 tons daily to the Belmont mill and the Belmont mine tonnage and grade has been recently increased. The Tonopah Mining Co. ceased taking custom ore some time ago, and has been operating the Millers plant at capacity on its own mine ore.

Pioche Ore Shipments High

Shipments from the Pioche district for the week ended May 30 created a new record for the district, 3,615 tons being sent to smelters in Utah, Colorado, and Arizona. The shipments were distributed as follows: Virginia Louise mine, 1,115 tons; Combined Metals, 505 tons; Bristol Silver mines, 350 tons, Bullionville tailings, 1,220 tons, and Dry Valley tailings, 425 tons, a total for the week of 3,615 tons.

Prince Consolidated Ready to Proceed

The unwatering of the Prince Consolidated mine has been accomplished after many months of work, and with two pumping units now in place no further difficulty is expected. A station is being cut on the 835 level, the present bottom of the mine, in which to install a new Knowles condensing pump, with a rating of 870 gal. against a 900-ft. head. This pump will take a space 32 by 16 by 12 ft. and the station will be cut 40 by 30 by 18 ft. to house the equipment. The development of the mine will go forward as soon as the new pump is in place, and it is expected that in addition to the drifting to open up the area indicated by diamond-drill holes to contain what is known as the silver bed, the shaft will be sunk to tap the zinc ore bed known to exist at a depth of 1,100 ft.

ARIZONA

New Owners of Henrietta Mine Will Produce

The Henrietta mine, situated in Yavapai County, near Mayer, has been purchased by Robert A. Young, representing Nelson Gray and associates of New York. The purchase price was $165,000 and the sale was effected by W. W. Lytzen, receiver of the Big Ledge Copper Co., the former owners. A reorganization is to be completed as soon as possible, and the new owners contemplate beginning development and production within a short time. The new mill, which was completed recently, will be put into operation, and the concentrates are to be shipped to the smelter of the Southwest Metals Co., at Humboldt. W. W. Lytzen, who was also superintendent of the property for the Big Ledge Copper Co., will be retained in that capacity by the new owners. The reorganized company will be called the Huron Copper Mining Co. There is a supply of milling ore already blocked out that can be immediately mined to supply the concentrator. This ore contains silver and gold in addition to the copper.

$350,000 Said to Be Available for Development

The United Magma Co., which is the consolidation of several properties south of Superior, has begun development. The old shaft, that was put down by the Calumet & Arizona at the time that it had bond on the Consolidated Holding Co.'s property, will be repaired and sinking resumed. It is expected that the shaft will be made 500 ft. deeper, which will make a total depth of 1,200 ft. Crosscutting will then be started both north and south at that horizon. The shaft is now in good condition, with the exception of the part above the water level. The company has provision for the expenditure of $350,000, and it is reported to have the backing of the Cole-Ryan, North Butte, and Hoatson interests. Chester Hoatson, of Calumet, Mich., is in charge of the work. The construction of a good road to the property, which is two miles from Superior, has been started.

Properties in Johnson District Will Be Developed

The Arizona United Development Co. has taken over two properties near Johnson, the Arizona United Mining Co. and the Dragoon Mountain Copper Mining Co. These are the two most important properties of the Johnson district, and, when operated for some time several years ago, they produced a good tonnage of ore. George Wilson, of Globe, is president and manager of the new company and Samuel W. Traylor, of the Traylor Manufacturing Co., of Allentown, Pa., is associated with him in the enterprise. About twenty men are now at the property; the first work to be undertaken will be that of sinking the old Mammoth incline shaft from the 400 level. The properties that are to be operated under lease and

bond comprise about sixty claims. The ore is mostly chalcopyrite that will average 5 per cent copper, and the operators expect to be able to start shipment about June 15.

New Mill Depends on Financing

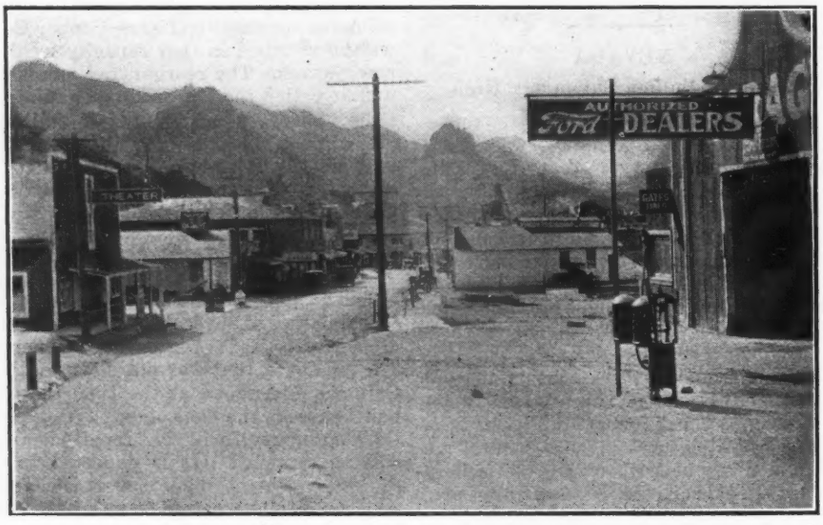
At a meeting of the stockholders of the Telluride Mining Co., held at the mine, near Oatman, it was agreed that it is advisable for the company to erect a new mill if it can be financed. The management estimates that over $1,000,000 worth of ore is blocked out. A previous attempt to ship ore to the Tom Reed mill did not prove profitable, owing to haulage and treatment costs, but it is estimated that a mill constructed at the mine will make possible the extraction of this ore at a profit.

NEW MEXICO

Chino Ships High-Grade to El Paso

The Chino Copper Co., at Santa Rita, has just mined one of the pockets of high-grade ore which have been encountered frequently in the course of mining the large low-grade orebodies. This particular pocket yielded 15 cars of high-grade, which was shipped direct to the El Paso smelter without preliminary treatment. Immediately before the Chino company took over the property lessees opened up rich pockets, and numerous small fortunes were made.

An unusual undertaking for a copper-mining company is the acceptance of an order by Chino from the Santa Fe Railroad for 1,500 tons of large rock to be shipped to Rincon and distributed therefrom for strengthening the revetments along the Rio Grande River in anticipation of the summer floods.



Main St. in Oatman, Ariz. (Note: This is not an "ad")

WASHINGTON

Resume of Activity in State

The gold mines of the Republic district, in Washington, are all working and producing gold ores in large quantity; these are shipped to the Trail smelter at Trail, B. C. Among heavy producers of this district which were idle last year and for several years preceding are the Last Chance, Knob Hill, Surprise, and the Quilp, which are shipping from two to five cars of ore each per week. The First Thought mines, near Orient, Wash., which have been idle for many years, last week started shipment of gold ore to the smelter.

The Black Rock mine, near Northport, is a steady producer of crude zinc ore, and is shipping several cars of ore to the Trail smelter weekly. The Gladstone mine, of the same district, is shipping lead ore continuously to the Bunker Hill smelter. The Addison Copper Co. is stoping ore on its property near Keller, Wash., and calling for bids for hauling 30 miles to Wilbur, Wash. The Consolidated Silver Mountain mine, near Addy, Wash., has begun the construction of a 50-ton concentrator at the mine. Owners of the Bead Lake mine, at Newport, Wash., have completed its concentrator, and several car loads of concentrates have been shipped.

MICHIGAN

Economies at Michigan Smelter

At the Michigan smelter, owned jointly by the Copper Range Consolidated and Mohawk-Wolverine companies, a saving of 30 per cent in fuel consumption is being effected by means of its coal-pulverizing plant, which has proved a marked success. A further saving in costs has been effected by doing away with cupola furnace operations, the percentage of copper in the slag being too low to warrant re-treatment. Arsenic, formerly wasted, is being recovered from the slag and converted into a paste to be marketed as an insecticide, which is particularly effective in ridding the farms of grasshoppers and other insect pests.

Copper Output at Maximum

Metal continues to be shipped as fast as it is produced at the smelters in the Copper Country. Copper shipments to mid-west centers, by rail, are particularly heavy. The amount of copper taken out by boat also is large, although some smaller purchasers apparently are holding off.

MONTANA

North Butte, Davis Daly and East Butte Netted Little in 1922

The annual report of the North Butte Mining Co. filed with the Clerk and Recorder of Silver Bow County, May 22, 1923, showed the capital stock of the company to be $9,000,000, of which $6,100,613.17 is invested in the State of Montana. During the year 1922 the business of the company amounted to $1,405,251.28 and the cost of operation totaled a like sum.

The report of the Davis Daly Copper Co. states that the capital stock of the company is $6,700,000. Of this amount $4,769,948.69 is invested in Montana. The gross business for the year 1922 amounted to $925,800.73. To transact this business the company spent $891,653.98. The report shows net profit of $34,146.75.

The East Butte Copper Co. shows its authorized capital stock as $6,000,000, of which amount $1,890,210.93 is invested in Montana. The gross amount of business in the state during 1922 amounted to $2,555,712.62. During the same year $2,554,067.74 was expended in operations in this state, and the actual net profit realized was $1,644.88.

JOPLIN-MIAMI DISTRICT

New Corporation Capitalized for $1,250,000

Interest has been aroused locally by the organization of the Amalamated Lead-Zinc Smelters Corporation, a $1,250,000 institution, headed by George W. Moore, of Joplin, one of the best-known mining men in this field. The company already is operating and has a modern zinc smelter of 3,000 retorts at Henryetta, Okla., capable of treating 160,000 lb. of zinc concentrates daily. It also has two operating mines at Picher, Okla., and a 208-acre lease now being developed. The two mines are among the steady producers of the Oklahoma field.

Mary Ann Drilling Shows Well

The Mary Ann Mining Co. has been successful in developing a good lease in Kansas, west of Baxter Springs. A total of forty-nine drill holes has been completed, the development work having been under way for a year and a half. Several of the drill holes show rich zinc and lead and a peculiar feature is that none of them show any shale, with one lone exception.

Golden Rod Gets Good Properties

The Golden Rod Mining & Smelting Co. has taken over the Leonora mine, in the south part of Picher, and is operating it. The property was originally developed by C. W. Chamberlain and associates and was afterward operated for a time by Elmer Gilbert and associates. The Golden Rod company has also recently taken over the Potosi mine and lease and is planning to work the dirt taken from it over its No. 6 mill, a surface track connecting the two properties already having been constructed.

Situation at the Mines

By Arthur B. Parsons
Assistant Editor

FOR THE FIRST TIME since August, 1918, miners of domestic silver are getting less than $1 for their metal. Moreover, they must look back as far as October, 1916, to find the time when the price was as low as it is today—65c. per ounce. On May 29 the Director of the Mint announced that he would discontinue purchasing bullion under the terms of the Pittman Act, but that, pending an audit of all receipts to date, tenders would be filed until June 15. There remains the possibility that the officials may be persuaded or compelled to purchase between 10,000,000 and 12,000,000 oz. represented by certain disputed allocations under the terms of the act, but so far as current operations in the mining districts are concerned, they now are based on the price of silver in the open market. To say that the change from $1 to 65c. silver will not be accompanied by some radical and disagreeable readjustments would be absurd. These will be particularly painful because recent unforeseen events have conspired to advance the date three or four months.

Important Domestic Producers of Silver

Silver-Gold

Betty O'Neal, Nevada	Tonopah Belmont, Nevada
California Rand, California	Tonopah Divide, Nevada
Candelaria, Nevada	Tonopah Extension, Nevada
Mogollon, New Mexico	Tonopah Mining, Nevada
Presidio, Texas	United Comstock, Nevada
Rochester, Nevada	Vipont, Utah
Talache, Idaho	West End Consolidated, Nevada

Lead-Silver

Bay Horse, Oregon	Iron Silver, Colorado
Bingham Mines, Utah	Ontario, Utah
Bunker Hill & Sullivan, Idaho	Ophir Hill, Utah
Cardiff, Utah	Park-Utah, Utah
Chief Consolidated, Utah	Silver King Coalition, Utah
Federal M. & S., Idaho	Silver Plume, Colorado
Gladstone, Washington	Tintic Standard, Utah
Hecla, Idaho	Tamarack & Custer, Idaho
Hercules, Idaho	United States S., R. & M., Utah
Idaho Continental, Idaho	Yak Tunnel, Colorado
Iron Blossom, Utah	Utah-Apex, Utah

Zinc-Silver-Lead

Butte & Superior, Montana	Silver Dyke, Montana
Callahan Zinc-Lead, Idaho	Simon Silver Lead, Nevada
Elm Orlu, Montana	Smuggler-Union, Colorado
Park City Mining & Smelting, Utah	Snowstorm, Montana
	Tomboy, Colorado

Copper-Silver

Anaconda, Montana	North Butte, Montana
Arizona Commercial, Arizona	Old Dominion, Arizona
Calumet & Arizona, Arizona	Phelps Dodge, Arizona
Davis-Daly, Montana	Southwest Metals Corporation, Arizona
East Butte, Montana	United Verde, Arizona
Engels Copper, California	United Verde Extension, Arizona
Iron Cap, Arizona	Utah Consolidated, Utah
Kennecott, Alaska	Utah Copper, Utah
Magma Copper, Arizona	

Stated bluntly, a great deal of rock that was "pay ore" with silver at one dollar is worthless with silver at 65c. Any mine that was running exclusively on such ore will, under usual conditions, discontinue production. Particularly is this true because there is no diminution whatever in the cost of operations. On the other hand, the tendency seems to be for both wages and the cost of supplies to increase. Some enterprises have already suspended operations; others will follow. Some will be compelled to select higher-grade ore to make profit; some that have been "picking the eyes" out of the oreshoots in order to make high-grade shipments before the Pittman Act purchases were completed, will now revert to more systematic mining. These, of course, have orebodies of higher average grade than those in the preceding class. Some lead, zinc, and copper miners whose ore contains silver in varying amount have been selectively mining ore richest in silver. Many of them will change their policy.

The importance of the completion of the Pittman Act purchases to the operations of any particular company will depend upon the ratio that the value of the silver in its ore bears to the gross metal value of the ore. I have listed most of the mines in the United States in which silver is an important constituent of the ore, in the accompanying table. It is significant that a very large proportion of the big mines in the Rocky Mountain states are represented. The group that has been hardest hit is that captioned silver-gold. Of these the United Comstock is least affected, because its ore contains a larger proportion of gold than that of any of the others. Reports from Tonopah are to the effect that none of the larger mines will shut down immediately, at least.

Silver is very important to most of the mines in the lead-silver group, even though the lead may be the greater source of income. Nevertheless, the proceeds on an ore assaying 10 oz. in silver are cut $3 per ton, and that may easily be the margin between profit and loss. The same holds true of the other two groups, but, generally speaking, the silver content of their ore is less than that of the lead-silver group. The Coeur d'Alene mines, in Idaho, contend that with a reasonable lead market the price of silver will not cause any change in their operations. Most of the Utah operators are of like mind. Nevertheless, profits must inevitably be diminished.

An illustration of the incidence of the Pittman Act on a zinc mine is the case of Butte & Superior. Its annual income from silver is likely to fall about $750,000 below what it would be with $1 silver. Costs are not reduced one cent, so that this sum represents diminished dividends.

It is not unreasonable to anticipate some relief from the labor stringency in the mining districts as a consequence of the curtailment of operations that have been supported by "dollar" silver. This is one ray of light in a sky that for the moment is none too bright, what with copper receding from 16⅛ to 14½c., lead from 7½ to 7¼c., and zinc from 6¾ to 6¼c. during May. Many Arizona copper producers profess to be well satisfied with 15c. copper, but when the market falls below that point they are less cheerful, and are willing to admit it. At the same time there has been no noticeable curtailment in the rate of production anywhere.

In California, the Walker Mining Co. is increasing largely the capacity of its copper concentrator, and the Iron Mountain, Mammoth, and Calaveras Copper mines are taking steps to resume.

Two new mills have just been started in Nevada: a 100-ton flotation plant by the Hilltop Nevada, near Battle Mountain, and a 50-ton cyanide plant at Bellehelen, near Tonopah.

Utah mines are due for a reaction with the completion of the Pittman Act purchases. The Tintic Standard, for example, has shipped several $40,000 cars of high-grade silver ore recently; this is abnormal.

Phelps Dodge's Clifton smelter is in regular operation and will output 2,000,000 lb. of copper in May. Alterations in the Miami mill have increased its daily capacity by 400 tons. Production for Coeur d'Alene mines during May was at top speed. The Idaho Continental is shipping monthly 500 tons of concentrate averaging 70 per cent lead and 40 oz. silver, and Talache 500 tons of 75-oz. silver concentrate. The Republic district, in Washington, is shipping 1,400 tons of $16 gold ore per month.

Things continue to hum in the Joplin-Miami district. Output is at the rate of 12,500 tons of concentrate weekly. Southeast Missouri, producing half the current lead output of the country, is prosperous.

A decrease of 500,000 lb. in copper production in Michigan is accounted for by shortage of labor. The Franklin Mining Co., idle for two years, has resumed.

A wage increase of from 10 to 15 per cent went into effect in the Lake Superior iron-mining region during May. Common labor is now $4.20, compared with $3.75 formerly.

A gradual strengthening of confidence on the part of American capitalists is observable in the Mexican metal mining situation. Capital is all that is needed to make profitable enterprises in the land of Senor Obregon.

THE MARKET REPORT

Daily Prices of Metals

May	Copper, N. Y. net refinery* Electrolytic	Tin 99 Per Cent	Tin Straits	Lead N. Y.	Lead St. L.	Zinc St. L.
31	14.50	41.875	42.625	7.25	7.05	6.40
June1	14.50@14.625	41.00	41.875	7.25	7.00@7.05	6.40
2	14.50@14.625	40.00	41.25	7.25	7.00@7.05	6.375@6.40
4	14.625@14.75	41.125	41.75	7.25	7.00@7.05	6.375@6.40
5	14.625@14.75	41.25	42.00	7.25	7.00	6.35@6.40
6	14.675@14.75	41.375	42.00	7.25	7.00	6.30@6.35
Av.	14.619	41.104	41.917	7.25	7.021	6.379

*These prices correspond to the following quotations for copper delivered: May 31st, 14.75c.; June 1st and 2nd, 14.75@14.875c.; 4th and 5th, 14.875@15.00c.; 6th, 14.925@15.00c.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for deliveries constituting the major markets, reduced to the basis of New York cash, except where St. Louis is the normal basing point, or as otherwise noted. All prices are in cents per pound. Copper is commonly sold "delivered," which means that the seller pays the freight from the refinery to the buyer's destination.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. The quotations are for prompt deliveries. Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

The quotations are arrived at by a committee consisting of the market editors of *Engineering and Mining Journal-Press* and special representative of the Bureau of Mines and the Bureau of Foreign and Domestic Commerce.

London

May	Copper Standard Spot	Copper Standard 3M	Copper Electrolytic	Tin Spot	Tin 3M	Lead Spot	Lead 3M	Zinc Spot	Zinc 3M
31	66½	67	73	200	200	25¾	25⅛	31½	30⅞
June 1	66⅞	67½	73	197	197¼	25⅞	25⅛	31¼	30¾
4	67⅜	68	73½	197⅛	197¼	25¾	25	31	30½
5	66⅞	67⅜	73½	197⅜	197⅜	25⅞	25⅛	30¾	30⅜
6	66⅝	67¼	73½	196⅞	196⅞	25¾	25⅛	30⅝	30¼

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver and Sterling Exchange

May	Sterling Exchange "Checks"	Silver New York Domestic Origin	Silver New York Foreign Origin	Silver London	May	Sterling Exchange "Checks"	Silver New York Domestic Origin	Silver New York Foreign Origin	Silver London
31	4.62⅛	99⅜	66	32	4	4.62½	...	65⅜	31 11/16
June1	4.62¼	...	65⅝	31⅞	5	4.62⅛	...	65¼	31 11/16
2	4.62⅞	...	65⅝	31⅞	6	4.62 7/16	...	65½	31¾

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine. Sterling quotations represent the demand market in the forenoon. Cables command one-quarter of a cent premium.

Average Metal Prices for May

Copper:	
New York Electrolytic	15.440
London Standard	67.460
London Electrolytic	76.568
Lead:	
New York	7.306
St. Louis	7.085
London	25.614
Silver:	
New York, foreign	67.043
New York, domestic	99.625
London	32.611
Sterling Exchange	462.252
Zinc:	
St. Louis	6.625
London	31.057
Tin:	
99 per cent	42.346
Straits	43.135
London	203.097
Antimony	7.477
Quicksilver	68.000
Platinum	115.077

Metal Markets

New York, June 6, 1923

The sentiment in the non-ferrous metal market today is somewhat better than a week ago, though business has not been active and prices show little change. The news from Europe seems a bit more encouraging and conditions in that market have been the governing factor recently.

Copper

A few large orders were placed last week at 14.75c., delivered, this being the lowest price reached for electrolytic copper of standard shapes. At that level sufficient buying support was received to absorb all the metal offered and the price has reacted upward so that today practically all producers are asking 15c., delivered. However, consumers are not yet anxious to buy, and although business has been done during each of the last three days at 15c., it has been confined principally to lots of 25 to 100 tons. Producers believe that July and August requirements of consumers have not been provided for to any great extent and that it is, therefore, now a poor time to force sales.

The export demand continued quiet all week, but this morning an encouraging lot of orders were received at prices in the neighborhood of 15.25c., c.i.f. These were largely for spot delivery.

Lead

The official price of the American Smelting & Refining Co. continues at 7.25c., New York. This is also the price at which most others are selling, though a premium of five or ten points is asked for the small quantities of spot metal that are required. Producers are pretty well cleaned up of metal for delivery before the end of the month. Sales during the week have been unusually small and there is some hint of a slightly decreased consumption. Two out of three paint manufacturers interviewed reported a slight falling off in their business and two of the smaller battery manufacturers have cut down a little on the amounts of contract lead that they have been taking recently. A slight decrease in consumption may easily be offset, however, by a decrease in production owing to the ending of the Pittman Act silver purchases, and by the fact that European lead is not now coming to this country.

The St. Louis market is slightly weaker and in the last two days the 7c. price has become more general. Desilverized lead has been available all week in Chicago at from 7.075 to 7.10c. There seems to have been a little more selling pressure in the Middle West in the last two days.

Zinc

Galvanizers have bought a little more freely during the last three days, but the market still has no strength and the tendency is slightly downward. Most of the demand lately has been for July delivery, this resulting in producers being left with more June zinc than

they expected to have. As a result the premium on prompt deliveries has disappeared. Today, 6.35c. is nominally quoted by most producers. High-grade zinc continues to find a ready market at 8.25@9c., delivered, depending upon the seller and the delivery point. Prime Western in New York continues at the customary freight differential of 35c. per 100 lb. above the St. Louis market.

Tin

Most of the business has been between dealers. The statistics for May were disappointing and those for June are likely to be even more unfavorable. Forward tin has been about one-quarter cent below spot prices.

Arrivals of tin, in long tons: Total for May, 5,590. Of this, 4,930 was Straits; 400, English; 155, Chinese; 100, Banka and Billiton; and 5, Australian. June 1st, Straits, 25; China, 50; 2d, Straits, 25; China, 10; 4th, Straits, 725; Java, 200; 5th, China, 75; total so far in June, 1,110.

Gold

Gold in London: May 31st, 89s. 2d.; June 1st, 89s. 1d.; 4th, 89s.; 5th, 89s. 1d.; 6th, 89s.

Foreign Exchange

On Tuesday, June 5th, cable quotations on francs were 6.50c.; lire, 4.6825c.; marks, 0.0014⅝c.; and Canadian dollars, 2 3/32 per cent discount.

Silver

The market has shown an easier tendency lately probably owing to the announcement by the Director of the Mint on May 29th that the government had suspended purchases of silver under the Pittman Act.

Due to the suspension of purchases, the official quotation for domestic bar silver has also been suspended.

Mexican Dollars — May 31st, 51; June 1st, 50⅜; 2nd, 50⅜; 4th, 49¾; 5th, 49¾; 6th, 50.

Other Metals

Quotations cover large wholesale lots, f.o.b. New York, unless otherwise specified.

Aluminum—General market for 99 per cent grade, 27¼c. per lb.; 98 per cent, 26c. London, £115.

Antimony — Chinese and Japanese brands, 6.90c. W. C. C., 7.75c. Cookson's "C" grade, spot, 10@10½c. Chinese needle antimony, lump, nominal, 5.50c. per lb. Standard powdered needle antimony (200 mesh), 6@6.50c. per lb. White antimony oxide, Chinese, guaranteed 99 per cent Sb_2O_3, 7.75@8.25c.

Bismuth—$2.55 per lb. London, 10s.

Cadmium—$1 per lb. London, 5s.

Cobalt—Metal, $2.65@$2.85 per lb.; black oxide, $2 per lb. in bbls. London 12s. for metal; black oxide, 9s.

Iridium—$270@$280 per oz.

Magnesium—Sticks, 1⅛ in., 99.9 per cent, $1.25 per lb. London quotes 4s.@4s. 9d. for 99 per cent.

Molybdenum Metal—In rod or wire form, 99.9 per cent pure, $32@$40 per lb., according to gage. Metal powder, 96@98 per cent, $4.50 per lb. Dull.

Monel Metal — Shot, 32c.; blocks, 32c. per lb., f.o.b. Bayonne, N. J.

Nickel—27@32c. per lb. for 99 per cent virgin metal. London, £130@£135.

Osmium—Pure, $75@$80 per oz. troy, in Los Angeles.

Palladium—$80@$81 per oz. London, £17, nominal.

Platinum—$114 per oz. London, £24@£25 for manufactured. Sponge, £22@£23.

Quicksilver — $68 per 75-lb flask. San Francisco wires $66.50. London, £10 10s.

Radium—$70 per mg. radium content.

[1]**Rhodium**—$4.50@$5 per gram.

Selenium — Black powdered, amorphous, 99.5 per cent pure, $2.10 per lb.

[1]**Tellurium**—$3 per lb. in 10-lb. lots.

[1]**Thallium Metal**—Ingot, 99 per cent pure, $4 per lb. in 25-lb. lots.

Tungsten Metal—Powder, 97 to 98 per cent, $1 per lb. contained tungsten.

Metallic Ores

Chrome Ore—Indian chrome ore, $20.50 per ton, c.i.f. Atlantic ports. Rhodesian $20@$22 and New Caledonian, $23@$24, nominal.

Iron Ore—Lake Superior ores, per long ton, Lower Lake ports: Old Range bessemer, 55 per cent iron, $6.45; Mesabi bessemer, 55 per cent iron, $6.20; Old Range non-bessemer, 51½ per cent iron, $5.70; Mesabi non-bessemer, 51½ per cent iron, $5.55.

Magnetite Ore—F.o.b. Port Henry, N. Y.: Old bed 21 furnace, $5 per long ton; old bed concentrates, 63 per cent, $5.25; Harmony, cobbed, 63 per cent, $5.25; new bed low phosphorus, 65 per cent, $7.50.

Manganese Ore—40@45c. per long ton unit, seaport, plus duty; chemical ore, $75@$80 per gross ton.

Molybdenum Ore—75@85c. per lb. of MoS_2 for 85 per cent MoS_2 concentrates, plus duty.

Tantalum Ore—Hand-sorted ore, 70 per cent combined columbite-tantalite, 40c. per lb., South Dakota. Active.

[1]**Titanium Ores**—Ilmenite, 52 per cent TiO_2, ¾@1c. per lb. for ore. Rutile, 96 per cent TiO_2, 10c. per lb. for ore, with concessions on large lots or contracts.

Tungsten Ore — Wolframite, $8.25; scheelite, $8.50@$9 per unit of WO_3. Price gradually rising to point where Chinese ore can be imported which will be at about $10 per unit, i.e. $2.75 for ore and $7.14 for duty, total $9.89.

Uranium Ore (Carnotite)—Ore containing from 2 to 2½ per cent U_3O_8, $3.50 per lb. of contained U_3O_8.

Vanadium Ore—No quotation. Recently $1 per lb. of V_2O_5 content.

Zircon—$50 per ton.

Zinc and Lead Ore Markets

Joplin, Mo., June 2—Zinc blende, per ton, high, $41.50; basis 60 per cent zinc, premium, $39; Prime Western, $37.50@$38.50; fines and slimes, $37@$35; average settling price, all blende, $38.07; calamine, basis 40 per cent zinc, $18 per ton.

Lead, high, $106.70; basis, 80 per cent lead, $90; average settling price all lead, $103.20 per ton.

Shipments for the week: Blende, 11,088; calamine, 41; lead, 2,217 tons. Value, all ores the week, $656,260.

The difference between the reported buying basis and the settling price continues wide apart.

Platteville, Wis., June 2.—Blende, basis 60 per cent zinc, $40 per ton. Lead, basis 80 per cent lead, $90 per ton. Shipments for the week: Blende, 330 tons; lead, none. Shipments for the year: Blende, 14,895; lead 260 tons. Shipments for the week to separating plants, 636 tons blende.

Non-Metallic Minerals

Asbestos—Crude No. 1, $500; No. 2, $250@$325; long spinning fibers, $135@$200; magnesia and compressed sheet fiber, $100@$150; shingle stock, $60@$85; paper stock, $35@$42; cement stock, $10@$25; shorts, $8@$14—all per short ton, f.o.b. mines, Quebec, Canada. Market more stable than for some time past. Demand very good for spinning and cement grades.

Barytes — Crude, $8@$10 per ton; white, dry ground, $16@$18; white, wet ground, $22@$25 per ton; off color, dry ground, $13@$15; off color, wet ground, $15@$16, f.o.b. plant. Market is active.

Bauxite—American, crushed and dried, $6@$9 per gross ton; pulverized and dried, $12@$14 per gross ton; calcined, $22@$25 per gross ton, all f.o.b. shipping points. Foreign bauxite offered at $5@$8 per metric ton, c.i.f. Atlantic ports, depending upon grade.

Borax—Granulated and refined, crystals or powdered, in bags, carloads, 5¼c. per lb.; in bbls., 5½c. Boric acid, 11c.

Chalk—English, extra light, 5c. Domestic light, 4½@4¾c.; heavy, 3½@3¾c. per lb., all f.o.b. New York.

China Clay (Kaolin)—Crude, $7@$9; washed, $8@$9; powdered, $13@$20, f.o.b. Virginia points. Powdered clay, $14@$20, f.o.b. Virginia points. Imported lump, $15@$20, f.o.b. American ports; powdered, $45@$50, f.o.b., New York, 1A grade, refined, $15@$16 per ton, Delaware.

Canadian, in lumps, $16@$18, f.o.b. Quebec points. Demand good.

Diatomaceous Earth — Crude, air-dried material, in large lumps, $8 per ton, f.o.b. California quarries.

Emery—Turkish and Greek, 6@8c. per lb. American, 5c. Market good.

Feldspar — No. 1 pottery grade, $7 per short ton; No. 2, $6.50; ground, 160 mesh, $20; all f.o.b. New Jersey. No. 1 crude, $8 per short ton. New York mines. Market strong.

Fluorspar — Fluxing gravel, 85 per cent CaF_2 and not over 5 per cent silica, $23.50, f.o.b. mines; not over 6 per cent silica, $23; 80 per cent grade, not over 5 per cent silica, $22; ground

[1]Price furnished by Foote Mineral Co., Philadelphia, Pa.

acid grade, $45 in bulk; ground enameling grade, $35 in bulk; packages, $4 extra, all f.o.b. mines, Illinois.

Glass grade, 94 per cent, free from iron, lump, $23.75; plus 85 per cent CaF_2, minus 6 per cent SiO_2, flux, $15.50; both f.o.b. New Mexico. Market excellent and producers having no trouble to dispose of product.

Washed gravel, plus 85 per cent CaF_2, minus 5 per cent SiO_2, $23.50 short ton; acid lump, $42 short ton, f.o.b. Illinois. Market quiet. Small tonnages foreign spar continue to come in.

Fuller's Earth—16 to 60 mesh, $18 per ton; 16 to 30 mesh, $17; 30 to 60 mesh, $18; 60 to 100 mesh, $14; 100 mesh and finer, $7.50; f.o.b. Florida mines.

Graphite—American flake, 4@5c. per lb. at mines. Ceylon lump, first quality, 6½c. per lb.; chip 5½c.; dust, 4@4½c. Mexican crude amorphous, $15@$35 per ton, f.o.b. New York. Flake graphite, 10@30c. per lb.; foundry grades, 4@7c.; boiler, 8@14c.; lubricating, 10@50c. per lb.

Gypsum—Crushed rock, $3 per ton in most states. Ground, $3.50@$4, f.o.b. shipping points.

Kaolin—See China Clay.

Limestone—Crushed, New York State shipping points, ½ in. and larger, $1.10 @$1.35 per net ton. Agricultural limestone, $2.50@$3 per net ton, f.o.b. eastern shipping points.

Magnesite — Dead-burned magnesite grains, $40 per net ton, f.o.b. Baltimore; $40@$42, Chester, Pa.

Crude, $12.50 per ton; 85 to 90 per cent MgO calcined lump, $32.50@$35 per ton; calcined ground, in paper sacks, 90 per cent through 200 mesh, $40@$45 per ton—all f.o.b. California points.

Grecian caustic-calcined and ground, $51@$52 per ton, f.o.b. cars, Atlantic seaboard.

Dead-burned magnesite in bulk, $32 @$34 per net ton, Washington points.

Manjak—Barbados, in 1 to 5 ton lots, grade "C" lump, $330 per short ton; "C" fine, $250; grade "A," $185—all c.i.f. New York.

Mica—Domestic, No. 1 quality, 1½x2 in., 15c. per lb.; 2x2 in., 35c.; 2x3 in., 80c.; 3x3 in., $1.20; 3x4 in., $1.60; 3x5 in., $2; 4x6 in., $2.80; 6x6 in., $3.60, all per lb., f.o.b. North Carolina, thumb trimmed; 1½ in. disks, 75c. per lb. No. 2 stove mica: punch, 8c.; 2x2 in., 25c.; 2x3 in., 50c.; 3x3 in., $1; 3x4 in., $1.40; 3x5 in., $1.75; 4x6 in., $2.25; 6x8 in., $3.25. Flake, 12c. per lb. Scrap, $25 per ton. All f.o.b. Virginia points.

Scrap, $22 per short ton; washer, 8@10c. per lb.; disk, 15c. per lb., f.o.b. Connecticut points. Market active.

[1]**Monazite**—Minimum 6 per cent ThO_2, 6@8c. per lb.

Phosphate — 77 to 76 per cent tricalcium phosphate, hard rock, $7.50 per ton, f.o.b. Jacksonville; 77 to 76 per cent pebble grades, $6.75; 75 to 74 per cent pebble, $5.75; 70 per cent pebble, $4.35; 66 to 68 per cent pebble, $3.90, f.o.b. Tampa.

For 72 per cent washed run of mine, $5.50; 75 per cent washed lump, free of fines, $6.75; 78 per cent large lump, $8, all per long ton, Tennessee. Ground rock, 60@65 per cent, $5.50@$6.50 per short ton. Good demand for lump, free of fines, for furnace purposes. Fertilizer demand (using 72 per cent washed run-of-mine) poor. Shipping season for ground rock (for direct application) does not begin until July, but indications are for a good demand this fall.

Pumice Stone—Imported lump, 3@ 40c. per lb.; domestic lump, 5c.; ground, 5@6c., all f.o.b. New York.

Pyrites—Imported lump, 1 in. diameter and up, 11c. per long ton unit; furnace size, 2½ in. diameter, 12c. per long ton unit; fines, through ½-in. mesh, 11c. per long ton unit; cinder property of buyer, ex ship, Atlantic ports. Ore contains 50@51 per cent sulphur; cinder about 63 per cent iron. Market very limited.

Silica—No. 1 glass sand, $2.75 net ton, f.o.b. Pennsylvania; damp building, motor, and brick sand, $2. Market dull.

Sulphur—$16@$18 per ton for domestic, f.o.b. Texas and Louisiana mines; $18@$20 for export, f.a.s. New York.

Talc—Ground talc, 160 to 200 mesh, carloads in 50-lb. kraft bags, $7.50@ $9.50 per ton, f.o.b. Vermont. In burlap bags, $1 per ton less plus 10c each for bags. Market dull and demoralized, with heavy overproduction.

In New York, 325 mesh, $14.75 per ton for double air-floated short fibre talc. Market good.

In Vermont, coarse, $5 per ton, $1 for bags; fine, $8@$14, $1 for bags.

Roofing talc and soapstone, $7@$8 per ton. Paper grades, $10@$18 per ton, f.o.b. mill in Vermont.

Tripoli—Once ground, rose and cream colored, $16@$25; white, $18@$27; double ground, r. and c., $17@$25; w., $19@$30; air-float, r. and c., $25@$30; w., $35; super air-float, r. and c., $35@ $40; w., $40@$45. All per short ton in 200-lb. burlap bags with paper liners, minimum car, 30 tons, f.o.b. Missouri. Demand decreasing and buyers cautious.

Mineral Products

Arsenious Oxide (white arsenic)— Prompt, 13½c. per lb. June-July, 12c. Second half 1923, 11c. per lb.

Copper Sulphate — Large crystals, 5.90c. per lb.; small 5.80c. Quiet.

Sodium Nitrate—$2.55 per 100 lb., ex vessel Atlantic ports.

Potassium Sulphate—Basis 90 per cent, $43.67 per ton.

Sodium Sulphate—$26@$28 per ton, New York.

Ferro-Alloys

Ferrocerium—Per lb., $15@$20.

Ferrochrome—1 to 2 per cent carbon, 28@30c. per lb.; 4 to 6 per cent carbon, 12c. per lb.

Ferromanganese — Domestic, 78@82 per cent, $125@$130 per gross ton, f.o.b. furnace. Spiegeleisen, 19@21 per cent, $45@$47.50, f.o.b. furnace; 16@19 per cent, $43@$46.50.

Ferromolybdenum—$2@$2.50 per lb. of contained molybdenum for 50 to 55 per cent grades. Dull.

Ferrosilicon—10 to 12 per cent, $48 @$55 per gross ton, f.o.b. works; 50 per cent, $95 delivered.

Ferrotitanium—For 15 to 18 per cent material, $200@$225 per ton, f.o.b. Niagara Falls, N. Y.

Ferrotungsten — 92@97c. per lb. of contained W., f.o.b. works. Market firm.

Ferro-uranium—35 to 50 per cent U, $6 per lb. of U contained, f.o.b. works.

Ferrovanadium—$3.50@$4 per lb. of V contained, f.o.b. works. Very active.

Metal Products

Copper Sheets—New York base, 24.50c. per lb.; wire, 18c. base.

Lead Sheets—Full lead sheets, 10.25c. per lb.; cut lead sheets, 10.50c. in quantity, mill lots.

Nickel Silver—30.25c. per lb., for 18 per cent nickel Grade "A" sheets.

Yellow Metal — Dimension sheets, 21.50c. per lb.; rods, 18.50c. per lb.

Zinc Sheets—$9.20 per 100 lb., f.o.b. works.

Refractories

Bauxite Brick—$140@$145 per M., Pittsburgh, Pa.

Chrome Brick—$50 per net ton, f.o.b. shipping point.

Chrome Cement — $23 per net ton, f.o.b. shipping point.

Firebrick—First quality, $45@$47 per M., Ohio and Kentucky works; second quality, $41@$43.

Magnesite Brick — 9-in. straights, $65 per net ton, f.o.b. works.

Magnesite Cement—$47@$50 per net ton, f.o.b. Chester, Pa.

Silica Brick — $45 per M., Ohio; $48 Alabama.

[1]**Zirkite**—Powdered, $50@$60 per ton; brick, $100 per ton.

The Iron Trade

Pittsburgh, June 5, 1923

Steel production continues at substantially record high rate, ingots being made at about 50,000,000 tons per annum. A fair volume of steel business is being booked. A reassuring factor is that neither the heavy deliveries of late nor the conservative attitude all business interests have assumed has produced cancellations or postponements of consequence.

Pig Iron — Prices have yielded slightly more, bessemer being down 50c. and foundry $1 on actual sales, while offerings of a steel interest make basic quotable 50c. lower. Bessemer, $29; basic, $27; foundry, $29, Valley.

Connellsville Coke—Spot unchanged at $5@$5.25 for furnace and $6@$6.50 for foundry. No more consumers seem willing to pay $6 for third-quarter furnace coke, and it is rumored that as low as $5.50 has been quoted, though not on the best coke.

[1]Price furnished by Foote Mineral Co., Philadelphia, Pa.

METAL STATISTICS

Monthly Average Prices of Metals

Silver

	New York		London		Sterling Exchange	
	1922	1923	1922	1923	1922	1923
January	65.450	65.668	35.035	31.928	421.750	465.053
February	65.290	64.313	33.891	30.875	435.511	468.631
March	64.440	67.556	33.269	32.310	436.912	469.269
April	66.575	66.855	34.080	32.346	440.715	465.220
May	71.154	67.043	36.023	32.611	444.106	462.252
June	71.149		35.900		444.615	
July	70.245		35.644		444.165	
August	69.417		34.957		446.069	
September	69.515		35.305		442.800	
October	68.015		34.498		443.583	
November	65.177		32.882		447.484	
December	63.905		31.383		460.440	
Year	67.528		34.406		442.346	

New York quotations cents per ounce troy, 999 fine, foreign silver. London, pence per ounce, sterling silver, 925 fine.

Copper

	New York Electrolytic		London Standard		London Electrolytic	
	1922	1923	1922	1923	1922	1923
January	13.465	14.510	65.226	64.494	72.321	71.409
February	12.864	15.355	60.250	67.700	66.125	74.500
March	12.567	16.832	59.245	73.851	65.739	81.464
April	12.573	16.663	58.799	73.169	64.028	81.331
May	13.111	15.440	61.092	67.460	66.554	76.568
June	13.575		61.988		69.333	
July	13.654		63.137		70.321	
August	13.723		63.784		69.932	
September	13.748		63.113		70.917	
October	13.632		62.773		70.693	
November	13.598		62.795		70.216	
December	14.074		63.267		70.132	
Year	13.382		62.123		68.859	

New York quotations, cents per lb. London, pounds sterling per long ton.

Lead

	New York		St. Louis		London	
	1922	1923	1922	1923	1922	1923
January	4.700	7.633	4.388	7.571	23.667	27.119
February	4.700	8.050	4.396	8.093	20.681	28.519
March	4.720	8.252	4.421	8.254	21.266	28.815
April	5.115	8.101	4.946	7.996	22.993	26.956
May	5.420	7.306	5.281	7.085	24.462	25.614
June	5.745		5.563		24.685	
July	5.729		5.447		24.869	
August	5.824		5.537		24.580	
September	6.110		5.868		24.131	
October	6.530		6.338		25.551	
November	7.047		6.868		26.199	
December	7.163		6.978		26.079	
Year	5.734		5.503		24.097	

New York and St. Louis quotations, cents per lb. London, pounds sterling per long ton.

Tin

	New York 99%		New York Straits		London	
	1922	1923	1922	1923	1922	1923
January	31.480	37.986	32.100	39.173	163.065	181.852
February	29.835	40.693	30.767	42.011	149.850	190.513
March	28.426	46.569	29.171	48.569	143.152	219.607
April	29.810	44.280	30.605	45.810	149.840	213.081
May	30.149	42.346	30.971	43.135	150.163	203.097
June	30.707		31.497		152.512	
July	31.025		31.733		156.149	
August	32.134		32.380		160.006	
September	32.075		32.395		160.065	
October	33.935		34.600		170.563	
November	35.911		36.734		179.341	
December	36.480		37.695		178.697	
Year	31.831		32.554		159.450	

New York quotations, cents per lb. London, pounds sterling per long ton.

Zinc

	St. Louis		London	
	1922	1923	1922	1923
January	4.691	6.815	26.321	35.733
February	4.485	7.152	24.213	35.613
March	4.658	7.706	25.467	36.720
April	4.906	7.197	26.576	34.275
May	5.110	6.625	27.304	31.057
June	5.346		27.893	
July	5.694		29.042	
August	6.212		31.170	
September	6.548		31.750	
October	6.840		34.528	
November	7.104		38.011	
December	6.999		37.757	
Year	5.716		30.003	

St. Louis quotations, cents per pound. London, pounds sterling, per long ton.

Antimony, Quicksilver and Platinum

	Antimony (a) New York		Quicksilver (b) New York		Platinum (c) New York	
	1922	1923	1922	1923	1922	1923
January	4.463	6.884	49.960	72.731	97.260	112.462
February	4.416	7.290	48.295	70.636	89.545	113 273
March	4.319	8.885	50.204	70.808	87.500	110 846
April	4.980	8.380	52.280	69.200	87.500	116.840
May	5.467	7.477	54.885	68.000	85.529	115.077
June	5.145		55.115		87.212	
July	5.091		55.000		90.180	
August	5.315		57.593		98.370	
September	6.580		67 640		117.280	
October	6.905		72.560		109.440	
November	6.584		71.521		108.000	
December	6.382		72.300		113.600	
Year	5.471		58.946		97.618	

(a) Antimony quotations in cents per lb. for ordinary brands. (b) Quicksilver in dollars per flask. (c) Platinum in dollars per ounce.

Pig Iron, Pittsburgh

	Bessemer		Basic		No. 2 Foundry	
	1922	1923	1922	1923	1922	1923
January	21.55	29.27	20.15	27.35	21.34	28.77
February	21.46	29.79	19.71	28.15	20.88	27.21
March	21.35	32 03	19.96	31.79	20.83	31.77
April	22.50	32.77	21.26	32.77	22.70	32.77
May	26.36	31.87	26.87	29.83	25.96	32.46
June	26.96		26.96		25.96	
July	26.77		26.33		25.97	
August	30.44		27.18		30.81	
September	35.27		34.70		36.79	
October	35.27		31.77		33.40	
November	33.52		29.37		30.55	
December	29.87		26.34		27.69	
Year	27.61		25.88		26.91	

In dollars per long ton.

Monthly Crude Copper Production

	1923			
	January	February	March	April
Alaska shipments	4,698,184	7,975,434	4,684,081	6,886,159
Washoe Smelter	16,250,000	15,600,000	20,250,000	19,400,000
Calumet & Arizona	3,738,000	2,998,000	3,506,000	3,520,000
Calumet & Hecla	(c)	(c)	(c)	(c)
Other Lake Superior	(c)	(c)	(c)	(c)
Chino	(c)	(c)	(c)	(c)
East Butte	(c)	(c)	(c)	(c)
Inspiration	(c)	(c)	(c)	(c)
Miami	5,679,000	5,059,000	5,310,000	5,017,000
Nevada Cons.	(c)	(c)	(c)	(c)
New Cornelia	3,034,000	2,666,557	3,181,928	3,155,615
Old Dominion	2,250,000	2,098,000	2,530,000	3,271,600
Phelps Dodge	7,783,000	7,329,000	8,767,000	7,668,000
Ray	4,670,692	(c)	(c)	(c)
Shattuck Arizona	(c)	(c)	(c)	(c)
Southwest Metals Co.	971,180	.....	.....	.....
United Verde	(c)	(c)	(c)	(c)
United Verde Extension	3,083,500	3,220,306	3,621,074	3,759,160
Utah Copper	(c)	(c)	(c)	(c)
Others, estimated	10,500,000	11,500,000	12,500,000	10,500,000
Total United States	.....	.....	.....	.....
Imports: Ore and concentrates, matte	6,320,680	.....	.....	.....
Imports of black and blister, unrefined	19,008,647	.....	.....	.....
Imports of refined and old	13,154,582	.....	.....	.....
Grand total	.....	.....	.....	.....
Backus & Johnston	(c)	(c)	(c)	(c)
Boleo	1,280,554	.....	1,302,053	1,519,245
Cananea	(c)	(c)	(c)	(c)
Cerro de Pasco	(c)	(c)	(c)	(c)
Chile	(c)	(c)	(c)	(c)
Cons. M. & S. of Canada	(a)	(a)	(a)	(a)
Falcon Mines	582,000	567,200	.....	.....
Furukawa	2,677,742	2,645,337	3,233,515	.....
Granby Cons.	3,586,661	3,589,377	3,251,360	3,217,577
Hampden Cloncurry	.....	.....	.....	.....
Katanga	9,223,515	7,829,955	8,824,410	8,531,145
Mount Morgan	490,000	832,000	.....	.....
Mount Lyell	1,352,000	1,012,000	.....	.....
Phelps Dodge Mexican	2,850,000	3,118,000	3,960,000	3,940,000
Sumitomo	.....	1,377,643	2,563,681	2,663,750
Wallaroo & Moonta	354,372	357,626	.....	354,397

Comparative Annual Copper Production

	1920	1921	1922	1923
January	121,903,744	90,596,597	32,010.292	112,341,000
February	117,540,000	86,682,941	45,957,530	102,641,000
March	120,309,316	91 046,345	55,705,760	122,190,000
April	116,078,871	46,946,523 (b)	76,601,000	.....
May	114,964,207	25,310,511 (b)	88,714,000	.....
June	116,107,856	24,623,693 (b)	93,740,000	.....
July	109,729,610	22,033,739 (b)	91,000,000	.....
August	112,460,254	23,248,398 (b)	101,188,000	.....
September	104,919,562	23,855,316 (b)	96,408,000	.....
October	105,231,571	23,231,572 (b)	103,273,000	.....
November	106,700,178	28,341,442	102,845,000	.....
December	95,709.009	29,629.137	103,003,000	.....

(a) No copper produced during this month. (b) Department of Commerce. (c) Not available.

Imports of Ores and Metals in March

Imports of metals and ores during March, 1923, with revised comparative figures for March, 1922, compiled from the returns to the Department of Commerce, were as follows:

Imports

In Pounds Unless Otherwise Stated

	March 1922	March 1923
Antimony		
Metal matte and regulus	2,441,872	545,440
Copper and brass		
Ore	1,005,357	5,073,427
Concentrates	2,799,997	3,489,000
Regulus, coarse metal and cement copper	169,070	5,060
Total	3,974,424	8,567,487
Imported from		
Spain	223,280	450,240
Canada	261,892	431,490
Mexico	.....	5,008,563
Cuba	2,224,641	2,566,797
Chile	252,909	57,682
Peru	3,226	20
Venezuela	.....	14
Other countries	1,008,476	52,681
Unrefined black, blister and converter copper		
In pigs and bars	21,687,676	27,128,296
Imported from		
Spain	4,054,402	.....
United Kingdom	4,512,504	11,407
Canada	.....	3,136,236
Mexico	1,775,996	2,112,932
Chile	.....	7,368,357
Peru	6,862,247	9,900,644
Portuguese Africa	4,482,527	4,320,183
Other countries	.....	278,537
Refined copper	9,254,715	17,535,909
Old and clippings for remanufacture	4,097,807	620,669
Composition metal, copper chief value	108,129	65,601
Copper manufactures	.....	6,933
Brass		
Old and clippings for remanufacture	16,358,710	6,584,470
Manufacture of brass	.....	24,618
Ore and matte	642,376	16,041,499
Bullion or base bullion	13,034,908	3,708
Pigs, bars, other forms and old	.....	8,483,866
Manufactures of lead (except type metal)	.....	18,521
Type metal (lead content)	.....	3,745,030
Manganese ore, long tons	15,120	12,799
Pyrites, long tons	7,533	28,606
Tin		
Tin ore, tons	566	242
Tin in bars, blocks and pigs	15,783,259	18,364,724
Imported from		
United Kingdom	3,327,204	5,455,749
British Straits Settlements	10,892,979	11,851,087
China	.....	2,239
Dutch East Indies	279,922	.....
Hongkong	281,845	754,378
Australia	270,172	123,200
Other countries	731,137	178,071
Zinc ore (dut.)	153,408	12,970
In blocks and pigs (dut.)	.....	6,717
Zinc dust and other manufactures	.....	6,887

The French Non-Ferrous Metal Market

SPECIAL FOREIGN CORRESPONDENCE

The demand for copper continues much restricted. Industrial companies continue drawing on their stocks and will not order more until those stocks are exhausted. However, future prospects of copper purchases are excellent. Numberless electrifying schemes are being planned or carried out: electrical equipment of rural districts, harnessing of water power and similar projects. All the provinces of France are showing great activity in this respect, stimulated by the certainty of the passing by Parliament at an early date of a bill authorizing state advances toward the electrification of rural areas. The French Minister of Public Works has just approved of the plan for the first instalment of electrification of both the Orléans and Midi railroad systems from 1923 to 1927. On the Orléans, 916 km. are to be electrified, and 1,576 km. on the Midi system.

Tin has but a small outlet in France, and is neglected at present. The lead market is irregular, but, owing to the building trade being now in full swing, prospects are good. This also applies to zinc. The strike of Belgian railway men has interfered with the export of Belgian zinc sheets and has stimulated the French production somewhat. Belgian production of zinc for the last four months has been as follows, in metric tons: January, 10,650; February, 11,340; March, 12,990; and April, 12,610.

The French company which is mining nickel ore in New Caledonia has recently not given good returns. Sales have decreased, and so keen was the competition that prices have fluctuated widely. The high cost of labor and transportation has necessitated reducing the production of both raw and manufactured metal.

The Société Minière Le Cinabre has just been organized with a capital of 6,000,000 fr., to work cinnabar deposits situated in former Hungarian territory now annexed to Czecho-Slovakia.

Hopes are being entertained that Piscataway antimony works, situated near New York, and belonging to the Antimony & Compounds Co., a creation of the French Société Nouvelle des Mines de la Lucette, which have been idle for some time, may be restarted soon, as a consequence of increased tariff protection.

Copper, Lead and Zinc Exports April, 1922 and 1923

Exports of copper, lead and zinc during April, 1923, with revised comparative figures for April, 1922, as compiled from the returns to the Department of Commerce, were as follows:

Exports of Copper, Lead and Zinc

In Pounds

	April, 1922	April, 1923
Copper		
Ores, concentrates matte, and regulus (copper content)	119,198	74,680
Copper and manufactures of (total)	71,181,538	65,710,561
Refined, in ingots and bars	62,196,956	55,891,315
Exported to		
Belgium	4,106,706	4,070,119
France	13,956,127	16,067,575
Germany	17,983,470	10,012,738
Italy	3,789,074	3,778,407
Netherlands	2,713,069	572,687
Spain	1,151,654	828,691
Sweden	1,370,041	1,774,904
United Kingdom	3,914,443	12,043,890
Canada	265,219	2,634,122
China	4,664,269	2,282,800
Japan	6,327,092	1,522,954
Other countries	1,955,792	302,428
Old and scrap	88,368	232,515
Composition metal, copper chief value	9,803	4,640
Pipes and tubes	196,084	159,338
Plates and sheets	590,378	240,515
Wire except insulated	2,217,709	734,976
Insulated wire and cable	1,047,857	1,119,441
Lead		
Pigs and bars		
From domestic ore	1,511,657	118,930
From foreign ore	4,864,938	2,352,922
Exported to		
France	.....	224,039
Germany	1,568,510	.....
Netherlands	112,077	224,059
United Kingdom	2,634,283	1,568,084
Argentina	809,232	.....
Brazil	430,188	224,084
Japan	112,000	.....
Other countries	710,305	231,586
Zinc		
Dross	2,418,607	1,527,541
Spelter		
From domestic ore	4,542,824	3,479,343
From foreign ore	448,000	5,964
Total zinc, slabs and blocks	4,990,824	3,485,307
Exported to		
Belgium	.....	336,047
France	2,167,732	560,011
United Kingdom	1,189,051	2,563,443
Canada	58,258	2,098
Japan	1,064,094	.....
Other countries	511,689	23,708
In sheets and strips	582,531	594,010
Zinc dust	170,665	484,876
Other zinc manufactures	23,323	122,711

Calumet & Hecla Increases Stock

At a meeting of the stockholders of the Calumet & Hecla Mining Co. held in Boston on June 4 it was voted to increase the capital stock from 100,000 shares of $25 par value to 800,000 shares of the same par value. Present shareholders will get eight shares of the new stock for one share of the old. It was also voted to declare the stock fully paid. It is said that this increase in the number of shares is the first step in the merger of the Calumet & Hecla with its four subsidiaries — Ahmeek, Allouez, Centennial, and Osceola mining companies.

MINING STOCKS

Week Ended June 2, 1923

Stock	Exch.	High	Low	Last		Last Div.
COPPER						
Ahmeek	Boston	71	70	70½	Mar. 23, Q	$1.00
Alaska-Br. Col.	N. Y. Curb	2¾	2	2½		
Allouez	Boston	...	...	24½	Mar. '19	1.00
Anaconda	New York	46½	44	44½	Apr. '23, Q	0.75
Arcadian Consol.	Boston	2¼	1½	1½		
Ariz. Com'l	Boston	11	10½	10½	Oct. '18, Q	0.50
Calaveras	N. Y. Curb	2¼	2⅛	2⅛		
Calumet & Arizona	Boston	55	53¼	53½	Mar. '23,	1.00
Calumet & Hecla	Boston	380	365	370	Mar. '23, Q	7.00
Centennial	Boston	...	...	9½	Dec. '18, SA	1.00
Cerro de Pasco	New York	44	41½	42	May '23,	1.00
Chile Copper	New York	27⅜	26⅛	26½	Mar. 23,	0.62½
Chino	New York	23⅜	21⅞	22	Sept. '20, Q	0.37½
Con. Coppermines	N. Y. Curb	3½	3½	3½		
Copper Range	Boston	36	33	33	May '23, Q	1.00
Crystal Copper	Boston Curb	1 7/16	1¼	1 7/16		
Davis-Daly	Boston	3	2½	2½	Mar. '20, Q	0.25
East Butte	Boston	7⅜	7⅛	7⅛	Dec. '19, A	0.50
First National	Boston Curb	46	46	46	Feb. '19, SA	0.15
Franklin	Boston	*60	*34	*37		
Gadsden Copper	N. Y. Curb	...	...	*80		
Granby Consol.	New York	24⅜	24⅛	24⅛	May '19, Q	1.25
Greene-Cananea	New York	24½	24	24	Nov. '20, Q	0.50
Hancock	Boston	...	...	2½		
Howe Sound	N. Y. Curb	3⅛	3⅛	3⅛	Jan. '21, Q	0.05
Inspiration Consol.	New York	34⅜	31⅜	32	Apr. '23, Q	0.50
Iron Cap	Boston Curb	6⅜	5⅛	6½	May 23, K	0.15
Isle Royale	Boston	24⅛	24⅛	24⅛	Mar. '23, Q	0.50
Kennecott	New York	38⅛	35⅝	35⅞	Apr. '23, Q	0.75
Keweenaw	Boston	...	...	1⅜		
Lake Copper	Boston	3	2½	2½		
Magma Copper	New York	34	30½	30½	Jan. '19, Q	0.50
Mason Valley	N. Y. Curb	2¼	1⅜	1⅜		
Mass Consolidated	Boston	2	1⅜	1⅜	Nov. '17, Q	1.00
Miami Copper	New York	26⅜	25½	25½	May '23, Q	0.50
Michigan	Boston	...	...	1½		
Mohawk	Boston	54	51½	51½	Mar. '23, Q	1.00
Mother Lode Coa	New York	10	9½	10	Mar. '23, K	0.50
Nevada Consol.	New York	14⅜	13⅞	14	Sept. '20, Q	0.25
New Cornelia	Boston	19	18	18	May '23, Q	0.25
North Butte	Boston	8	7½	7½	Oct. '18, Q	0.25
Ohio Copper	N. Y. Curb	*69	*50	*60		
Old Dominion	Boston	23½	22½	23	Dec. '18, Q	1.00
Osceola	Boston	34½	33	33	Mar. '23, K	1.00
Phelps Dodge	Open Mar.	†185	†175	...	Apr. '23, Q	1.00
Quincy	Boston	35	32	32½	Mar. '20, Q	1.00
Ray Consolidated	New York	13⅛	13	13	Dec. '20, Q	0.25
Ray Hercules	N. Y. Curb	1⅜	1¼	1⅜		
St. Mary's Min. Ld.	Boston	40	40	40	Mar. '23, K	3.00
Seneca Copper	New York	8½	8	8½		
Shannon	Boston	*70	*70	*70	Nov. '17, Q	0.25
Shattuck Arizona	New York	7⅜	7⅛	7⅛	Jan. '20, Q	0.25
South Lake	Boston	*17	*17	*17		
Superior & Boston	Boston	1⅜	1 5/16	1 5/16		
Tenn. C. & C. cfs	New York	10⅛	9⅞	9⅞	Apr. '23, Q	0.25
Tuolumne	Boston	...	...	*35	May '13,	0.10
United Verde Ex	N. Y. Curb	34⅛	33	33½	May '23, Q	1.00
Utah Consol.	Boston	2½	1⅞	2⅛	Sept '18,	0.25
Utah Copper	New York	66¼	64	64½	Mar. '23, Q	1.00
Utah Metal & T.	Boston	*90	*90	*90	Dec. '17,	0.30
Victoria	Boston	...	...	1		
Winona	Boston	*80	*80	*80		
Wolverine	Boston	7⅞	7⅞	7⅞		
NICKEL-COPPER						
Internat. Nickel	New York	14	13¾	13¾	Mar. '19,	0.50
Internat. Nickel pfd.	New York	79	78½	78½	May '23, Q	1.50
LEAD						
Carnegie Lead & Zinc	Pittsburgh	...	...	4		
National Lead	New York	124½	118	120½	Mar. '23, Q	2.00
National Lead pfd.	New York	108⅜	108⅜	108⅜	Mar. '23, Q	1.75
St. Joseph Lead	New York	19½	18½	19½	Mar. '23, Q, X	0.50
ZINC						
Am. Z. L. & S.	New York	13½	11½	12½	May '20,	1.00
Am. Z. L. & S. pfd.	New York	44½	44½	44½	Nov. '20, Q	1.50
Butte C. & Z.	New York	7⅞	7½	7⅞	Mar. '23,	0.50
Butte & Superior	New York	25⅛	22⅞	23½	Mar. '23, Q	0.50
Callahan Zn-Ld	New York	7½	6½	6½	Dec. '20, Q	0.50
New Jersey Zn.	N. Y. Curb	161½	160	160	May '23, Q	2.00
United Zinc	N. Y. Curb	1	1	1		
Yellow Pine	Los Angeles	*58	*58	*58	Sept. '20, Q	0.03
SILVER						
Alvarado	N. Y. Curb	...	...	5		
Batopilas Mining	New York	⅜	⅛	¼	Dec. '07, I	0.12½
Beaver Consol.	Toronto	*37½	*35½	*35½	May '20, K	0.03
Candelaria	N. Y. Curb	*10	*6	*7		
Castle-Trethewey	Toronto	*25	*24	24		
Coniagas	Toronto	3.00	2.70	2.70	May '21, Q	0.12½
Crown Reserve	Toronto	*61	*58½	*59	Jan. '17,	0.05
Hilltop-Nev.	N. Y. Curb.	1½	1 7/16	1½		
Kerr Lake	N. Y. Curb	2¼	2⅛	2⅛	Apr. '23, Q	0.12½
La Rose	Toronto	*36	*30	*30	Apr. '22,	0.10
McKinley-Dar.-Sav.	Toronto	*20	*17½	*17½	Oct. '20, Q	0.03
Mining Corp. Can.	Toronto	2.90	2.75	2.90	Sept. '20, Q	0.12½
Nipissing	N. Y. Curb	5⅛	5⅛	5⅛	Apr. '23, Q	0.15
Ontario Silver	New York	5¼	5¼	5¼	Jan. '19, Q	0.50
Temiskaming	Toronto	*43	*39	*39	Jan. '20, K	0.04

Stock	Exch.	High	Low	Last		Last Div.
GOLD						
Alaska Gold	New York	⅛	⅛	⅛		
Alaska Juneau	New York	1⅛	1	1		
Boundary Red M.	N. Y. Curb	*35	*30	*30		
Carson Hill	Boston	7	6	6		
Cresson Consol. G.	N. Y. Curb	3½	3½	3½	Apr. '23 Q	0.10
Dome Mines	New York	37½	34½	36½	Apr. '23, Q	0.50
Golden Cycle	Colo. Springs	1.12½	1.09½	1.10	Dec. '22, Q	0.02
Hollinger Consol.	Toronto	12.15	12.08	12.15	May '23, M	0.05
Homestake Mining	New York	63½	63	63½	May '23, M	0.50
Kirkland Lake	Toronto	*49	*46	*46		
Lake Shore	Toronto	3.30	3.25	3.30	May '23, Q	0.02
McIntyre-Porcupine	New York	18⅛	17½	17½	May '23, Q	0.25
Portland	Colo. Springs	*39	*39	*39	Oct. '20, Q	0.01
Teck-Hughes	N. Y. Curb	1⅜	1⅛	1⅜		
Tom Reed	Los Angeles	*80	*67½	*71	Dec. '19,	0.02
United Eastern	N. Y. Curb	2 1/16	1⅝	2	Apr. '23, Q	0.15
Vipond Cons.	Toronto	*64½	*54	*54		
White Caps Mining	N. Y. Curb	*7	*7	*7		
Wright-Hargreaves	Toronto	3.40	3.15	3.15	Apr. '23,	0.02½
Yukon Gold	N. Y. Curb	1⅞	1⅝	1⅝	June '18,	0.02½
GOLD AND SILVER						
Boston-Mont. Corp.	N. Y. Curb	*15	*12	*15		
Cons. Virginia	San Francisco	10½	10½	10½		
Continental Mines	N. Y. Curb	5	4½	4½		
Dolores Esperanza	N. Y. Curb	1⅜	1¼	1⅜	Apr. '23	0.05
Jib Consol.	N. Y. Curb	*95	*92	*92		
Tonopah Belmont	N. Y. Curb	*98	*78	*78	Apr. '23, Q	0.05
Tonopah Divide	N. Y. Curb	*64	*54	*54	May 23	0.10
Tonopah Extension	N. Y. Curb	2½	1 11/16	1 11/16	Jan.' 23, Q, X	0.10
Tonopah Mining	N. Y. Curb	1⅜	1⅛	1 1/16	Apr. '23, Q	0.07½
Unity Gold	N. Y. Curb	4¼	4⅛	4⅛		
West End Consol.	N. Y. Curb	*98	*92	*92	Mar. '23, Q	0.05
SILVER-LEAD						
Bingham Mines	Boston	17	17	17	Sept. 19, Q	0.25
Cardiff M. & M.	Salt Lake	*67	*60	*60	Dec. '20,	0.15
Chief Consol.	Boston Curb	4⅛	4⅛	4⅛	May '23, Q	0.10
Columbus Rexall	Salt Lake	*74	*50	*64	Aug. '22,	0.03
Consol. M. & S.	Montreal	25⅜	25	25⅜	Oct. '20, Q	0.62½
Federal M. & S.	New York	8	8	8	Jan. '09,	1.50
Federal M. & S. pfd.	New York	45⅜	38	38	Mar '23, Q	1.75
Florence Silver	Spokane	*38	*38	*38	Apr. '19, Q, X	0.01½
Hecla Mining	N. Y. Curb	8	8	8	Mar. '23,	0.25
Iron Blossom Con.	N. Y. Curb	*30	*30	*30	Apr. '22, Q	0.02½
Marsh Mines	N. Y. Curb	*15	*14	*14	June '21, I	0.02
Park City	Salt Lake	3.20	3.20	3.20	Apr. '23,	0.12½
Park Utah	N. Y. Curb	3⅛	3	3	Apr. '23	0.15
Prince Consol.	Salt Lake	*6½	*5	*5¼	Nov. '17,	0.02½
Silversmith	Spokane	*40	*40	*40	Apr. 23,	0.01
Simon Silver Lead	N. Y. Curb	*30	*30	*30	...	...
Snow Storm Silver-L	N. Y. Curb	1	*95	*95		
Tamarack-Custer	Spokane	1.37	1.32	1.35	Jan. '21, K	0.04
Tintic Standard	Salt Lake	3.20	3.00	3.00	Dec. '22, Q, X	0.10
Utah-Apex	Boston	4⅛	4	4⅛	Nov. '20, K	0.25
IRON						
Bethlehem Steel	New York	55½	50⅜	52½	Apr. '23, Q	1.25
Char. Iron	Detroit	...	...	1		
Char. Iron, pfd	Detroit	2½	2½	2½		
Colorado Fuel & Iron	New York	35⅜	31⅜	33	May '23, Q	2.00
Col. Fuel & Iron pfd.	New York	...	...	102	Feb. '23, Q	2.00
Gt. North'n Iron Ore	New York	30	28⅜	28⅜	Apr. '23	1.00
Inland Steel	N. Y. Curb	...	...	46½	June '23 Q	0.62½
Mesabi Iron	N. Y. Curb	...	...	9		
Replogle Steel	New York	21	19	19		
Republic I. & S.	New York	53¼	48½	49½	May '23	1.50
Republic I. S. pfd.	New York	95½	95½	95½	Apr. '23	1.75
Sloss-Sheffield S. & I.	New York	52½	49½	49½	Feb. '21	1.50
Sloss-Shef. S. & I. pfd.	New York	...	...	81	Apr. '23	1.75
U. S. Steel	New York	99½	94½	95⅜	Mar. '23, Q	1.25
U. S. Steel pfd.	New York	118½	117½	117½	May '23	1.75
Virginia I. C. & C.	New York	59½	59	59	Jan. '22	1.50
Virginia I.C.&C.pfd.	New York	...	...	83	Jan '23	2.50
VANADIUM						
Vanadium Corp.	New York	33⅞	31½	32½	Jan. '21, Q	1.00
ASBESTOS						
Asbestos Corp.	Montreal	62½	62½	62½	Apr. '23 Q	1.50
Asbestos Corp. pfd.	Montreal	...	...	83½	Apr. '23 Q	1.75
SULPHUR						
Freeport Texas	New York	14⅞	13⅜	13⅜	Nov. '19, Q	1.00
Texas Gulf	New York	63½	59½	59½	May '23, Q	1.50
PLATINUM						
So. Am. Gold & P.	N. Y. Curb	3	3	3		
MINING, SMELTING AND REFINING						
Amer. Metal	New York	47	45½	45⅝	Mar. '23, Q	0.75
Amer. Metal pfd.	New York	...	...	114	Mar. '23, Q	1.75
Amer. Sm. & Ref.	New York	61⅛	58⅜	59⅜	Mar. '21, Q	1.00
Amer. Sm.& Ref. pfd	New York	98	97½	97½	Mar. '23 Q	1.75
U. S. Sm. R. & M.	New York	31½	30½	31½	Jan. '21, Q	0.50
U.S. Sm.R.& M. pfd.	New York	43¾	43¾	43¾	Apr. '23 Q	0.87½

*Cents per share. †Bid or asked. Q, Quarterly. SA, Semi-annually. M, Monthly. K, Irregular. I, Initial. X, Includes extra.

Toronto quotations courtesy Arthur E. Moysey; Spokane, Pohlman Investment Co; Salt Lake, Stock and Mining Exchange; Los Angeles, Chamber of Mines and Oil; Colorado Springs, Colorado Springs Stock Exchange.

Current Prices of Mine Materials and Supplies

RISE AND FALL OF THE MARKET

Advances—Blue annealed and black steel sheets, higher than month ago at Pittsburgh mill. Blue annealed also higher in San Francisco warehouses. Track bolts up 25c. per 100 lb. at mill; rise reflected in San Francisco warehouses. Wrought-steel pipe discounts reduced 5 points in New York and 6⅔ in Chicago warehouses, during month. Pine and hemlock timbers higher in Kanas City; fir, advanced in Cincinnati. Wire nail prices up in San Francisco and St. Louis. Linseed-oil stable in New York; rose 2c. per gal. in Chicago, since last month.

Declines—Maximum price of steel structurals down 15c. per 100 lb. at Pittsburgh mill during month, due to disappearance of premiums for early shipment. Pine timbers down $1.50 per M. ft. in Chicago; hemlock and spruce lower in Boston. Slight reduction in pine oil during month.

SHEETS—Quotations are per 100 lb. in various cities from warehouse also the base quotations from mill:

	Pittsburgh, Large Mill Lots	St. Louis	Chicago	San Francisco	New York
Blue Annealed					
No. 10	$3.00@3.25	$4.25	$4.15	$5.10	$4.59
Black					
No. 28	3.85@4.00	5.00	5.00	6.15	5.15
Galvanized					
No. 28	5.00@5.25	6.10	6.10	7.00	6.15

STEEL RAILS—The following quotations are per ton f.o.b. Pittsburgh and Chicago for carload or larger lots:

	Pittsburgh			
	Current	One Year Ago	Birmingham	Chicago
Standard bessemer rails	$43.00	$40.00	....	$43.00
Standard openhearth rails	43.00	40.00	$43.00	43.00

TRACK SUPPLIES—The following prices are base per 100 lb. f.o.b. Pittsburgh for carload lots, together with the warehouse prices at the places named:

	Pittsburgh					
	Current	One Year Ago	Chicago	St. Louis	San Francisco	Birmingham
Standard spikes, ⅝-in. and larger	$3.15	$2.25	$3.00	$4.15	$5.00	$3.60
Track bolts	4.25@4.50	3.00@3.50	4.00	5.15	6.20	4.60
Standard section angle bars	2.75	2.40	2.75	4.00	4.25	3.00

STRUCTURAL MATERIAL—Following are base prices f.o.b. mill, Pittsburgh and Birmingham together with quotations per 100 lb. from warehouses at places named:

	Pittsburgh, Mill	Birmingham Mill	New York	Dallas	St. Louis	Chicago	San Francisco
Beams, 3 to 15 in.	$2.50@2.60	$2.75	$3.64	$4.50	$3.45	$3.40	$3.95
Channel, 3 to 15 in.	2.50@2.60	2.75	3.64	4.50	3.45	3.40	3.95
Angles, 3 to 6 in., ¼ in. thick	2.50@2.60	2.75	3.64	4.50	3.45	3.40	3.95
Tees, 3 in. and larger	2.50@2.60	2.75	3.64	4.50	3.45	3.40	3.95
Plates	2.50@2.60	2.75	3.64	4.60	3.45	3.40	3.95

WIRE ROPE—Discounts from list price, f.o.b. New York and east of Missouri River, on regular grades of bright and galvanized are as follows:

Hercules red strand, all constructions	20%
Cast steel round strand rope	20%
Galvanized steel rigging and guy rope	7½%
Round strand iron and iron tiller	5%
Plow steel round strand rope	35%
Special steel round strand rope	30%

	New York	Cleveland	Chicago
Drill Rod (from list)	55%	40@55%	50%

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the latest Pittsburgh basing card:

	Inches	Steel Black	Galv.	Inches	Iron Black	Galv.
BUTT WELD	..1 to 3	62	50½	⅜ to 1¼	30	13
LAP WELD	2½ to 6	59	47½	2½ to 4	26	11

STEEL PIPE—From warehouses at the places named the following discounts hold for steel pipe:

	Black		
	New York	Chicago	St. Louis
2½ to 6 in. lap welded	44%	47%	49%

CAST-IRON PIPE—The following are prices per net ton for carload lots:

	New York					
	Current	One Year Ago	Birmingham	Chicago	St. Louis	San Francisco
6 in. and over	$58.50	48.80@49.80	$49.00	$60.20	$57.60	$60.00

Nuts—	New York	Cleveland	Chicago
Hot pressed, sq., per 100 lb. Off list	List net	$2.75	$2.50
Cold punched, sq., per 100 lb. Off list	List net	2.75	2.50

HOLLOW TILE—Price per block in carload lots to contractor for hollow building tile.

	New York						
	Current on Trucks	One Year Ago	Chicago	Philadelphia	St. Louis	San Francisco	Perth Amboy N. J., Factory
4x12x12	$0.1573	$0.1112	$0.0825	$0.125	$0.09	$0.108	.....
6x12x12	.2097	.1667	.1135	.....	.126	.156	.....
8x12x12	.2621	.2084	.1547	.19	.170	.244	$0.2691

MACHINE BOLTS—	New York	Cleveland	Chicago
1½ and 1¼x3 in. up to 12 in.	15 %	50%	50%

LUMBER—Prices of rough Douglas Fir No. 1 common, in carload lots to dealers in yards at San Francisco. To contractors, $2 per M. ft. additional.

	6-8 and 12 Ft.	10-16-18 and 20 Ft.	22 and 24 Ft.	25 to 32 Ft.
3x3 and 4	$40.00	$41.00	$42.00	$45.00
3x6 and 8	40.00	41.00	42.00	45.00
4x4-6 and 8	40.00	41.00	42.00	45.00

Wholesale prices to dealers of long leaf yellow pine. To contractors in New York City, delivered from lighters or cars to job, $5 additional.

	New York		Chicago	
	20 Ft. and Under	22-24 Ft.	20 Ft. and Under	22-24 Ft.
3x4 to 8x8	$52.00	$53.00	$52.50	$54.50
3x10 to 10x10	56.00	57.00	55.50	57.50
3x12 to 12x12	60.00	61.00	58.50	60.50

Other Cities	8 x 8-In. x 20 Ft. and Under				12 x 12-In. 20 Ft. and Under	
	Pine	Fir	Hemlock	Spruce	Pine	Fir
Boston	$65.00	$130.00	$60.00	$60.00	$85.00	$150.00
Cincinnati	42.00	55.00	.....	.....	50.00	.....
Denver	.....	43.00	43.00	43.00	.....	.....
Minneapolis	46.50	43.25	41.50	.....	50.00	47.75
Kansas City	50.00	46.50	46.50	.....	60.00	48.50
Birmingham	38.00	.....	.....	.....	45.00	.....

NAILS—The following quotations are per keg from warehouse:

	Pittsburgh, Mill	Chicago	San Francisco	Dallas	St. Louis	Montreal
Wire	$3.00	$3.45	$4.30	$4.25	$3.44	$4.95
Cut	.....	5.50	5.80	5.75	3.74	5.00

PORTLAND CEMENT—Prices to contractors per bbl. in carload lots *without bags*. Cash discount not deducted.

	Current	One Month Ago	One Year Ago
NewYork, del. by truck	$2.70@2.80	$2.70@2.80	$2.40@2.50
Chicago, f.o.b.	2.20	2.20	2.07
Cleveland, f.o.b.	2.46	2.46	2.36

LIME—Warehouse prices:

	Hydrated, per Ton		Lump, per Barrel 280-lb. net	
	Finishing	Common	Finishing	Common
New York	$18.20	$13.10	$3.75	$3.00@$3.25
San Francisco	22.00	16.00	....	(180-lb net) 1.75

LINSEED OIL—These prices are per gallon:

	New York		Chicago	
	Current	One Year Ago	Current	One Year Ago
Raw in barrel (5 bbl. lots)	$1.16	$0.91	$1.37	$1.03

WHITE AND RED LEAD—Base price in cents per pound:

	Red				White			
	Current		1 Year Ago		Current		Yr. Ago	
	Dry	In Oil	Dry	In Oil	Dry or In Oil	In Oil	Dry or In Oil	In Oil
100-lb. keg	14.50	16.00	12.25	13.75	14.50	12.25		
25 and 50-lb. kegs	14.75	16.25	12.50	14.00	14.75	12.50		

HOSE—

	Fire	50-Ft. Lengths
Underwriters' 2½-in. coupled		53c per ft.
	Air	
	First Grade	Second Grade
¾-in., 3 ply per ft.	$0.33	$0.25

Steam—Discounts from List

First grade..... 40-5% Second grade..... 45% Third grade..... 50%

RUBBER BELTING—The following discounts from list apply to transmission rubber and duck belting:

Competition..... 60-10% Best grade..... 50-10-5%

LEATHER BELTING—List price per ply, 12-in. wide, per lin. ft. $2.88.

Grade	Discount from list
Medium	30-10%
Heavy	20-5-2½%

RAWHIDE LACING
- For cut, best grade, 40%, 2nd grade, 50%.
- For laces in sides, best, 48c. per sq.ft.; 2nd, 43c.
- Semi-tanned: cut, 40%; sides, 48c. per sq.ft.

PACKING—Prices per pound:

Rubber and duck for low-pressure steam, ⅛ in.	$0.90
Rubber sheet	.45
Rubber sheet. wire insertion	.70

MANILA ROPE—Per lb., ¾-in. and larger, 1,200-ft. coils.

Atlanta	$0.22	New Orleans	$0.18½
New York	.18½	Seattle	.18
Chicago	.18	San Francisco	.18

EXPLOSIVES—Prices per pound of dynamite in small lots:

	Gelatin	
	40%	60%
New York	$0.275	$0.30
Minneapolis	.1967	.2173
Denver	.2075	.2325
Seattle	.165	.195
Cincinnati	.225	.25
New Orleans	.252	.285
San Francisco	.1625	.1925

FLOTATION OILS—All prices are per gal. in carload lots; 50-gal. bbls., gross weight 500 lbs.

Pine oil, steam dist., f.o.b. New York	$0.75
Pine oil, pure, dest. dist. f.o.b. New York	.75
Pine tar oil, ref. f.o.b. New York	.48
Pine tar oil, crude, tank cars f.o.b. Jacksonville, Fla.	.32½

CHEMICALS—

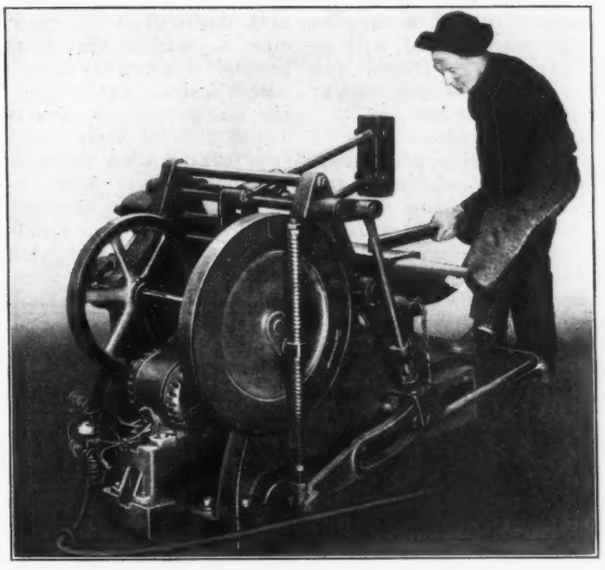
Zinc dust, 550 lb. casks, f.o.b. Palmerton, Pa., per lb.	$0.09½
Litharge, delivered New York, casks, 500 lb. lots, per 100 lb.	13.05
Sodium cyanide, 220 lb. case lots f.o.b. New York, per lb.	.25

NEW MACHINERY AND INVENTIONS

A Power Blacksmithing Hammer

Replaces Two Strikers in Shop Work—Blow Under Control of Operator

A mechanical hammer that will replace one or two human strikers in the blacksmith shop is found in the Blacker general utility power smithing hammer, which is being made by the Blacker Engineering Co., Inc., Grand Central Terminal, New York. The hammer strikes a maximum blow about four times as heavy as that of the average striker and is intended particularly for forging work that is too small to be done under steam hammers. It is completely under the smith's control, however, who can strike a light or heavy blow as he desires. The force of the blow varies directly with the depression of the treadle running around the anvil. Up to 140 blows per minute can be struck. Because of the rapidity with which it operates, work can be done in one heat that with hand strikers ordinarily would take longer. The work is always struck with the hammer perpendicular to the anvil, due to the way in which it is held. Heavy welds as well as the dressing of tools and articles with tapered ends can be performed rapidly. Material up to 2½ in. thick and larger can be handled. An anvil and a block of special design to suit the hammer are furnished.



Power-striking hammer for forge work

The hammer requires 1 hp. to drive it and can be run by a motor or from a lineshaft, being provided with tight and loose pulleys 15 in. in diameter. The hammer alone weighs 1,300 lb., the anvil 650 lb., and the stand 336 lb.

Deep Well Pump

A new type of deep well pump has recently been perfected by the Worthington Pump & Machinery Corporation, operating on a principle heretofore not used in pumps of this kind. Although the pump is of the rotary class the water is not elevated by means of a conventional type of impeller, but a form of propeller is used very similar to that employed for propelling ships.

In comparatively shallow wells, one set of impellers might suffice, but in deep wells a number of impellers are necessary, these being placed one under the other, thereby making the pump equivalent to a two stage, three stage, or other multi-stage pump.

Where it is desired or necessary to operate this pump by means of a horizontal motor, steam engine, internal-combustion engine, or by other means through a horizontal drive, a vertical pulley for belt driving may be used.

The impellers are made of hard bronze, capable of withstanding the corrosive action of the usual well water. The number of and angle of impeller blades, together with their width and thickness, vary with the conditions. The shaft is of nickel steel and is divided into easily handled lengths, coupled together by long steel couplings, insuring good alignment.

Among the advantages claimed for the pump are: Double the capacity of any other type of deep well pump from a given sized casing, excepting the air lift. Three to six times the capacity of a two-plunger reciprocating pump of the same size well. Exceeds the capacity of a centrifugal pump by 15 to 75 per cent. High efficiency, compact and simple construction; continuous flow; inexpensive foundation; direct motor drive or belted drive; low installation cost; and fewer wells.

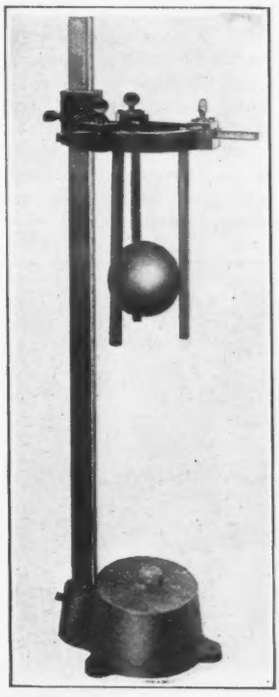
High-Duty Belt Fasteners

A new fastener has been designed for heavy belting under heavy strain at moderate speed and is made in sizes for belts from $\frac{5}{16}$-in. and upward in thickness. It embodies a new application of the compression principle as applied to belt fasteners. The size of the fastener is proportioned to the thickness of the belt for which it is designed. It is claimed that it is especially adapted for conveyor service, elevator belts and heavy transmission duty. Some of the features of these fasteners are: they grip the belt from both sides; they distribute the strain over the whole surface covered by the plates and not against the bolts alone; they are simply and quickly applied.

A pamphlet has been prepared giving details as to size, uses and methods of application of the Flexco fastener and will be sent upon application to the Flexible Steel Lacing Co., Chicago.

Ball-Testing Machine

A simple apparatus for determining the correct size of balls to be used in a cylindrical mill has been devised by John Herman, of Los Angeles, and is illustrated in the accompanying halftone. Its essential features consist of an anvil block, to receive a sample of the ore crushed to the size to be fed to the ball mill, and an adjustable guide, whereby balls of steel or other material may be dropped from various heights and the effect noted. A guard is placed around the anvil, to prevent loss of the broken rock, which may be subjected to screening analysis. The illustration shows a 4-in. ball in the act of dropping toward a test piece of rock on the anvil.



Ball-testing machine

INDUSTRIAL NOTES

Difficulties of Stripping Muskeg

Stripping problems on the iron ranges are not confined to the intensive work necessary in handling such enormous quantities of material. The character of the material enters into the situation decidedly. More than anything else, probably, the elusive material known as muskeg has been a source of trouble.

Muskeg is a vegetable deposit which burns like peat when dry and runs like quicksilver when wet. At Crosby, Minn., on the Cuyuna Range, burning muskeg gave a great deal of trouble during the stripping of Portsmouth mine by the Gordon Mining Co. This muskeg, covering the surface of a large field, had been burning several years when it finally was removed. The smouldering fires, which even the winters of northern Minnesota had failed to extinguish, were a real source of danger to the unwary. While smoking in places, the ground looked firm on the surface and sometimes tempted a careless workman to cross, only to sink to his hips in red-hot ashes.

On the Mesabi and the Gogebic ranges, the difficulty has been to take care of wet muskeg. Experienced contractors who did the original stripping at the Plymouth mine, Verona, Mich., pronounced the material the most difficult dirt to move they ever had met. "Where the steam shovel is working," said the superintendent, "the ground quivers like a piece of liver."

The contractor who opened the mine and the Plymouth company afterward handled the material in much the same way, using Western air-dump cars. A pipe line was laid to the muskeg dump, water being pumped from a neighboring water hole, and a stream of water was kept running on the dump. In consequence, when a car of muskeg was dumped, the saturated muskeg in the fill was pushed out by the weight of the material and flowed down and spread over the ground below like so much soft soap. The fill was left comparatively solid. By using this method it was possible to dump cars in the same spot for two or three weeks, the cars being dumped one at a time on reaching the saturated muskeg, without stopping the train. The Oliver Iron Mining Co. has been having similar difficulty near Virginia, Minn.

Some idea of the nature of the muskeg will be gained when it is known that 901 Western 20 cu.yd. dump cars, in one instance, were loaded without moving up the shovel. The muskeg slipped down from the hill above as fast as loaded. The appearance of the cars in the illustration and the splashing of the material tell an unusual story of steam-shovel excavation.

Contractors in digging the new Welland ship canal, in Ontario, are meeting plastic clay which is as difficult as muskeg. The methods used in handling such material may be of interest in this connection, as there is no essential difference between stripping a mine and any steam-shovel excavation of equal magnitude.

This plastic clay stretches like rubber and actually can be worked into the form of rope. In loading it packs into balls 6 ft. high, too large to pass under the door of a standard dump car. The contractors are handling this material much as muskeg is handled on the range, by using water put on through a hose. The Western air dump cars used in the hauling are thoroughly hosed before loading and a stream of water is turned on while dumping. The water on the dump makes a slippery skid, down which the material slips to such a distance that sometimes it is possible to dump for three or four days within a single car-length. In this case the dump cars are used without side doors, as even their very large clearance will not allow the passage of lumps 6 ft. in diameter. A few years ago one of the contractors handled similar material, encountered on a different section of the canal, by lining his dump cars with straw.

Handling clay in digging Welland ship canal, Ontario

Water running on to muskeg dump

TRADE CATALOGS

Electric Furnaces—Bulletin 3 of the Ajax Electrothermic Corporation, 636 East State St., Trenton, N. J., describes the new Ajax-Northrup 35-kva. converter and the various standard high-frequency furnaces which may be operated from it. The 35-kva. converter makes it possible to reach a uniform and controllable temperature of over 2,500 deg. C. in fifteen minutes in a furnace 2 in. in inside diameter and 7½ in. deep. The same converter applied to a larger furnace enables one to melt 45 lb. of nickel in 2½ hours from a cold start.

Oil Burning—The Combustion Engineering Corporation, Broad St., New York, has issued Bulletin QC-I, of 31 pp., describing Quinn fuel-oil-burning equipment.

Ammeters — The Roller-Smith Co., Bethlehem, Pa., has issued Bulletin No. 30, describing its "triplex" ammeter for three-phase a.c. circuits. This is a new type of ammeter recently developed for taking simultaneous readings in each of the three phases of a three-phase high-tension metering circuit.

Welding—The Manganese Steel Forge Co., Philadelphia, Pa., describes its Rol-Man manganese steel welding rods and electrodes for electric and gas welding in a four-page folder recently issued. These are intended for use in repairing cast and forged manganese steel parts of mine, mill, smelter and dredge equipment.